GAS

Spillway chimney for trench backfilling . . 31
A booster station run 95

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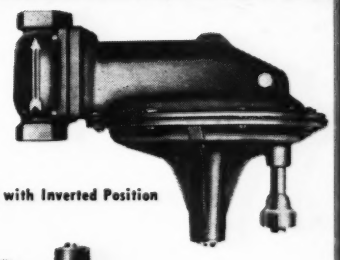
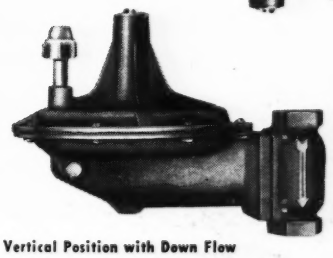


Up Flow with Inverted Position



Vertical Position with Down Flow

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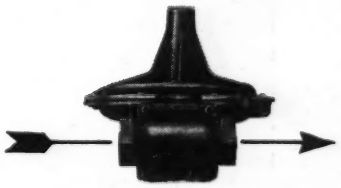

Normal Horizontal Position with Flow from Left to Right

Normal Horizontal Position with Flow from Right to Left

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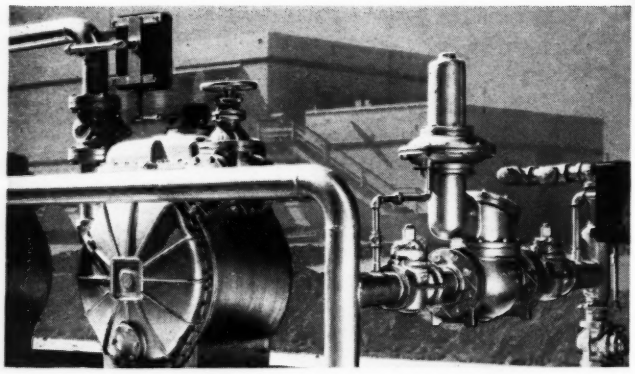
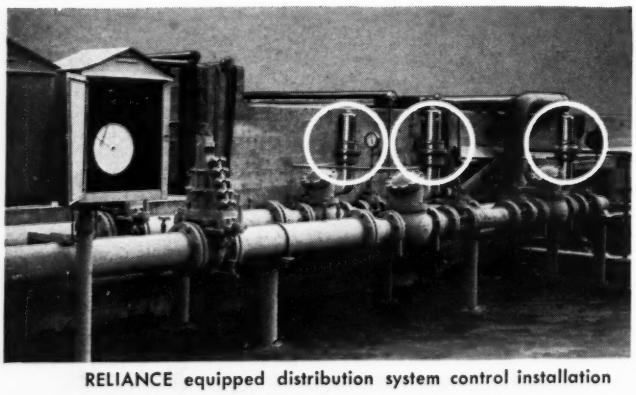


RELIANCE industrial control installation.



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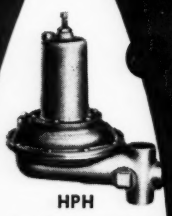

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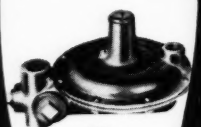

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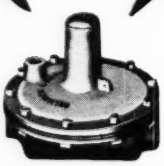

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Citizens Gas (Indianapolis) uses this unique method for cleaning mains. (See story on page 36.)

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Thermally Thinking

SPOT NEWS AND COMMENT ON GAS INDUSTRY AFFAIRS

Highlighting the News

PR report on press

AGA's public relations committee will spring its proposals for an industry-wide program this month, together with an appeal for subscribers. It looks good.

IGT speeds up curricula

Candidates for master's degrees from the Institute of Gas Technology can now win them in 15 months instead of 24. Fifteen fellowships are available for 1953.

Woodlawn case in court

OPS is making its debut before an emergency court of appeals to answer an appeal of Stanolind and Continental Oil to have the agency's 10-cent ceiling on gas from the Woodlawn field increased by 2 cents. The companies contend the fixing of ceilings based on sellers' rather than buyers' offers was illegal; OPS holds the setting of a ceiling in accordance with comparable prices in other fields was proper.

San Juan line case strengthened

The Seattle chamber of commerce has thrown its weight behind the Pacific Northwest Pipeline Corp.'s plan to pipe gas to the Northwest from the "Four Corner's" fields. And if the company wins a certificate, Colorado Interstate Gas Co.'s subsidiary, Colorado Oil & Gas Corp., would assign its estimated 464 billion cu ft of San Juan reserves to Pacific Northwest. In return, Pacific would deliver 100 MMcf per day for 20 years to Interstate at Rock Springs, Wyo., from where the latter company would build a new line to serve its home state. Pacific's case goes into hearings again Feb. 16.

Rate applications pile up

The FPC acted on a total of $148,953,000 in rate applications during 1952, a 65% increase over 1951. Of this amount, $148,101,000 was suspended and $852,000 accepted. (See pipeline news.)

Accelerated amortization

The issue of what rules, if any, FPC should adopt relating to the treatment for accounting and rate-making purposes of tax savings resulting from the allowance of accelerated amortization in income tax computation will be the subject of an FPC oral argument scheduled for March 11.

Rocky Mountain safety codes

The Rocky Mountain Gas Assn. has appointed four committees to follow up on the association's recently developed safety codes. For each of the four codes, the warm air heating and ventilating code, the gas fitting code, the domestic appliance code, and the administrative chapters of the general building code, a committee consisting of a chairman and two members is being appointed to keep the codes up to date during the next year or two and to handle inquiries concerning application or revision.

An Eye on the Capital

The Phillips case goes on

The Public Service Commission of Wisconsin, together with the cities of Milwaukee, Detroit, and Kansas City, whose officials, among other local and state officials constantly have been crying out against "federal encroachment" in recent years, are caught in the odd position of trying to get the Federal Power Commission to take jurisdiction in a case in which it disclaims jurisdiction.

It will be recalled that, in 1951, FPC ruled that its powers are not broad enough, under the existing statutes, to control prices of gas sold to interstate pipelines. However, the Public Service Commission of Wisconsin *et al* took the case to the U. S. Court of Appeals, and it is likely to end up in the Supreme Court. The issue before the court, on which hearings began Jan. 12, is whether FPC has jurisdiction over prices charged by Phillips Petroleum Co., a big producer of natural gas.

If FPC does have such power, such producers as Phillips believe the agency might be pressured into setting prices so low that oil companies producing natural gas as a by-product would not sell to the pipelines. The PSC of Wisconsin and the cities, however, feel that if FPC had jurisdiction, they could use political pressure toward lower natural gas rates for consumers in their areas.

At the hearing last month, a representative for the states of Texas, Oklahoma, and New Mexico stated that the Supreme Court has recognized the rights of the states to regulate natural gas prices at the wellhead and that action by the FPC to regulate such prices would conflict with the states' jurisdiction.

In other testimony, the deputy attorney general of Wisconsin told the court that if sales by Phillips to five pipeline concerns are unregulated, "we must attribute to Congress a futile gesture in passing the natural gas act," and the general counsel for the FPC argued that if the Appeals Court holds that Phillips is subject to commission jurisdiction, then "all producers and gatherers would be subject to it."

FPC, as noted, has ruled that it does not have the power to tell Phillips how much to charge for its natural gas. Therefore, the FPC lawyers, if the case goes to the Supreme Court, will be in the novel position (for a federal commission) of striving to prove that the FPC has no jurisdiction, while the local

Thermally Thinking

units, which constantly call for more state and local control, actually will be trying to get FPC to exercise more power than it says it has.

(P.S.: Wisconsin is Republican, too.)

Tax action may be delayed

Rep. John A. Dingell (D.-Mich.) has introduced H. R. 5, to abolish many, if not most excise taxes put on during World War II. Of particular interest in the gas industry is the fact that this bill would take the excises off gas appliances.

The outlook right now is not for tax action until late in the session, if then. Everyone seems to agree that appropriations ought to be taken care of as the first and most important order of business. Then, too, Mr. Dingell is now a minority member of the House Committee on Ways and Means, to which the bill was referred, and if an excise tax bill is brought out, it will be one written by, or bearing the name of, Rep. Daniel A. Reed (R.-N. J.), chairman of the committee.

Besides his hardy perennial calling for FPC supervision of safety requirements for all interstate natural gas pipeline systems, Rep. John W. Heselton (R.-Mass.), now an important majority member of the House Committee on Interstate and Foreign Commerce, has introduced H. R. 133, which would have the FPC report to Congress on the effect and operation of interstate compacts covering the conservation, production, transportation, or distribution of natural gas. Presumably, Mr. Heselton wants a full, official report that could be used to strengthen such compacts and to make less likely any demand for federal controls that do not exist. Representative Heselton is a former educator who has taken a greater-than-average interest (for a Congressman) in the gas industry.

A new chairman for the FPC

Politics over who will get the choice plum in the Federal Power Commission —its chairmanship—were a feature of the early maneuvering on Capitol Hill and among new Republicans in the White House.

Incidentally, President Harry S. Truman, before going out of office, again sent the nomination of Thomas C. Buchanan as FPC chairman to Capitol Hill but this was considered only a polite formality. The Senate turned him down last year and would certainly do so again, but President Eisenhower was expected to take Buchanan's resignation and to name someone else to the post.

Sen. Frank Carlson (R.-Kan.), who was for Eisenhower before Chicago, was plugging for Jeff Robertson, Kansas State Corporation commissioner, to get the $15,000-a-year post. On the other hand, former Gov. Sherman Adams (R.-N. H.), now chief White House assistant to President Eisenhower, is in favor of Nelson Lee Smith, veteran of the FPC since 1943, a former chairman under Truman, and, before that, a Dartmouth professor. Mr. Smith originally was named to the commission by the late F. D. R. He was supposed to be a minority—or Republican—member, but he has since described himself as an "independent," although likely not the same kind as Sen. Wayne Morse (Ind.-Ore.).

If Mr. Smith is named chairman of the FPC, prominent mention of Robertson's name indicates strongly that he may be appointed as a new member of that important regulatory body.

Commissioner Harrington Wimberley, of Oklahoma, has been re-elected vice chairman of FPC for the calendar year 1953. Mr. Wimberly, who has been a member of the FPC since Oct. 5, 1945, served as vice chairman during 1952 and prior to that held the post during part of 1947 and all of 1948.

Materials controls likely to continue

Although price, wage, and salary controls definitely are going out by April 30, if not before, and the Office of Price Stabilization is dying on the vine (its total number of employees is now only 4000, mostly in Washington), there is considerable doubt here as to whether materials controls will be allowed to go out.

It's understood that both Congressional leaders and President Eisenhower's advisers want to keep standby authority and a skeleton staff in existence on materials controls, just in case of some unexpected emergency. As a result, the future of Petroleum Administration for Defense is as much in doubt as the future of the Defense Production Administration and the National Production Authority.

At any rate, the agencies are likely to be in existence through mid-year. Second-quarter allocations for pipelines and for oil and gas country tubular goods already have been issued.

J. Ed Warren, Deputy Petroleum Administrator, declared that "oil-country tubular goods still are in critical short supply." He said that the lack of such goods has been a "large factor in limiting the drilling of new wells and consequently in building the reserve or productive capacity we would need in the event of war."

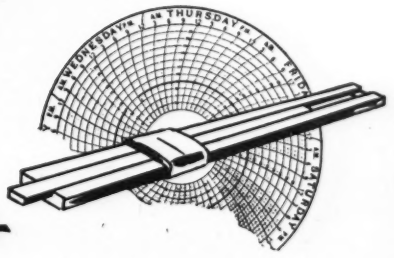
If the materials situation is as it is represented by Mr. Warren—and no one has disputed him—it is possible that oil-country tubular supplies and other goods used by the gas industry will be under controls at least through the remainder of this year. Only time will tell—if it has not already—what the new administration plans in this field.

New PAD study of the gas industry

Anyone with a working knowledge of the industry and its recent history can predict pretty flatly with little fear of contradiction, that (1) its growth

(Continued on page 70)

Technical Trends



• By GUY CORFIELD

Critical boundary velocity gradient

The critical boundary velocity gradient is a term and a concept developed by the flame research laboratories of the U. S. Bureau of Mines central experiment station at Pittsburgh, Pa., to explain and define the phenomena of flash-back and blow-off of fuel gas flames at burner ports. This concept appears to afford a means of predicting the interchangeability characteristics and limits of fuel gases as well as assisting in burner research and design.

As a gas-air mixture issues from a burner port, it does so with a velocity that is zero at the edge of the port and increases to a maximum at the center to form a cross-sectional pattern referred to as the velocity profile. When this mixture burns on the port in a stable manner, the position of the flame front or boundary of the inner cone is at points of equality between normal burning velocity and velocity of movement of the unburned gas-air stream. If the burning velocity is greater at any point flash-back will occur and if the gas-air stream velocity is greater blow-off will take place. This concept holds that the controlling velocity relationship exists at the boundary of the gas-air stream, near the edge of the port, and therefore the boundary conditions (boundary velocity gradient) are those that influence flame stability. The boundary velocity gradient at which the flame just flashes back into the burner is termed the critical boundary velocity gradient for flash-back (g_f); the gradient at which the flame just blows off the burner is termed the critical boundary velocity gradient for blow-off (g_b); the flame will be stable between these two limits.

This boundary velocity gradient, which is actually the slope of the curve of the gas-air stream velocity profile near the wall of the port, is obtained experimentally from laboratory operation of an atmospheric burner through measurement and calculation. The data are used to develop the flame stability diagram of a fuel gas wherein "critical boundary velocity gradients" are plotted against "gas concentration, fraction of stoichiometric" (the stoichiometric fuel gas percentage being the percentage of gas in a mixture having 100% primary air). Such a diagram is characteristic of the fuel gas from which it was developed and, within wide limits, is independent of the type and size of burner. In general, these diagrams can be used to predict burner performance on a given fuel with given air shutter, gas orifice, and gas line pressure settings, and also to predict the interchangeability of different fuel gases.

Certain limitations have been recognized and their importance is being studied. For instance, the concept does not apply to very small or very large ports, and requires modification for unusual shaped ports; the flash-back and blow-off limits of a gas change with temperature of the port and the unburned gas, and barometric pressure has a slight effect on flame stability; and the type of flow of the gas-air stream through the port (streamline or turbulent) is important.

Such a development is obviously of great interest to the gas industry, and the AGA is now cooperating with the Bureau of Mines in this investigation to "study and systematize the combustion characteristics of primary gases (hydrogen, carbon monoxide, methane, ethylene, nitrogen, etc.) singly and in mixtures, with particular respect to blow-off and flash-back characteristics; and to determine the possible application of such generalizations to the problems of interchangeability of fuel gases and improvement of burner design." This is being done in an activity of PAR as a joint project, PDC-3, of the domestic utilization and gas production research committees. An interim report No. 1, Study of Combustible Characteristics of Fuel Gases, explaining and discussing this concept and listing related bibliography, can be obtained from AGA headquarters.

Burning waste gases

On the Technical Trends page of the August 1952 issue of *GAS* a short item headed "Catalytic Desmogger" described a catalytic device developed by Eugene J. Houdry and produced and marketed by the Oxy-Catalyst Manufacturing Co. Inc., Wayne, Pa.

It consisted of a 0.003-in. thick coating of alumina and platinum on porcelain rods, and had the property of promoting the burning of a waste gas stream containing combustibles in such a dilute concentration as to be ordinarily non-flammable. One of the first applications, at a metal coating plant that discharged obnoxious solvent fumes from enameling ovens, assertedly resulted not only in elimination of odors but also in recovery of enough heat to cut the oven fuel costs substantially.

Applications of this catalyst are apparently continuing successfully, and broadening, so that the promoters feel that they will ultimately be able to save U. S. industry substantial sums of money as well as to eliminate air pollution worries. The catalyst is stated to have proved surprisingly active and long lived. As an example of oil industry adaptation, in an installation at the Sun Oil Co.'s refinery at Marcus Hook, the device is used to burn a dilute carbon monoxide and hydrocarbon mixture in regeneration flue gases from catalyst beds. A typical unit consists of 73 porcelain rods, 6 in. long, coated with the alumina-platinum alloy, held in staggered rows between porcelain end plates 3 in. square. The gases flow across these rods and combustion takes place on their surface to produce heat, which is recovered and used for steam generation.

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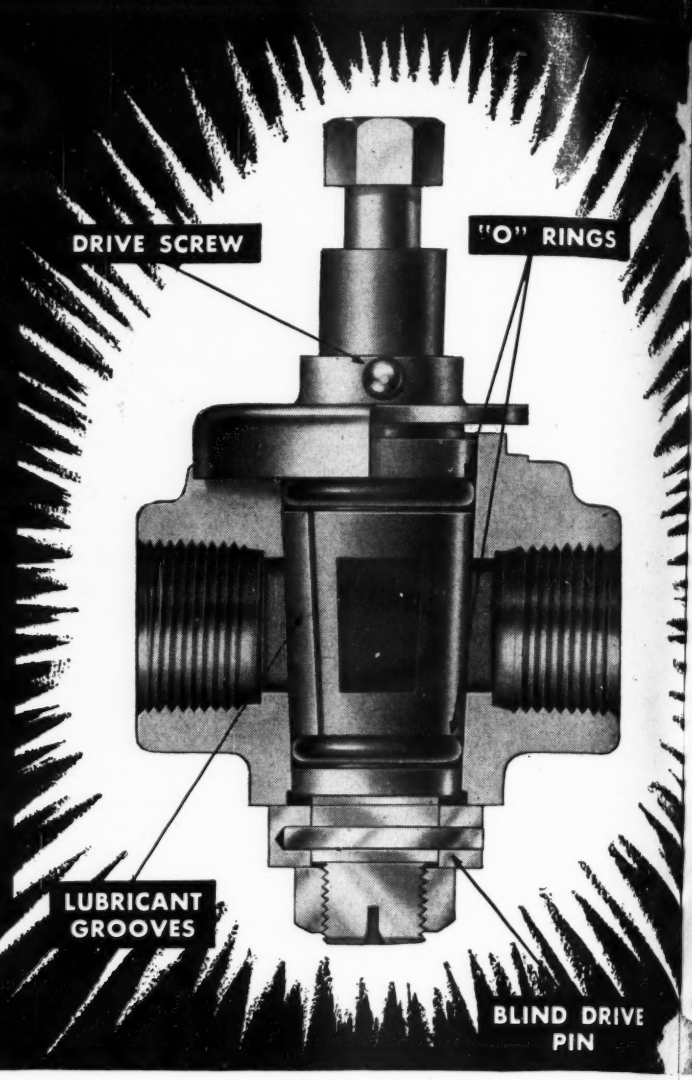

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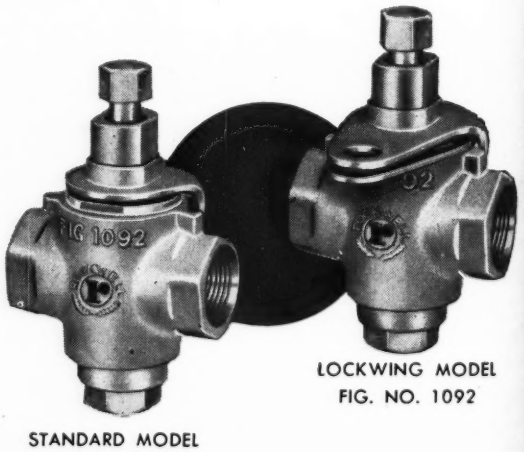

LOCKWING MODEL
FIG. NO. 1092

STANDARD MODEL
FIG. NO. 1092

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Nordstrom Service and Meter Cocks

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Another ROCKWELL Product

GAS exclusive

Soil characteristics for trench backfilling

By L. LE ROY CRANDALL • Dames & Moore, Los Angeles

THE subject of trench backfill is a relatively small part of soil engineering, and one that certainly deserves much more consideration than it has been given.

Soil mechanism is a relatively new field. It is the youngest of the civil engineering subjects; it has only been in the last two or three decades that engineers have begun to think of soil in terms of its engineering properties.

The science of soil mechanics probably began in 1925 when Karl Terzaghi published his theory of consolidation. The next major step came when R. R. Proctor developed and published a technique of compaction and compaction control i. e. placing loose materials so as to afford the requisite supporting characteristics to structures. Now, nearly every university in the country has some semblance of a soil engineering course.

The general features of soils and their characteristics are fairly well evaluated. We have any number of standard tests that engineers specializing in soils utilize to determine properties pertinent to a given problem. Unfortunately, soils are heterogeneous. That applies generally even to a given site or a portion of a site. You cannot take a sample at one spot and expect to have an identical material a few feet away from where you took that sample so we employ a statistical method of evaluating soil characteristics for design. The pipeline construction man has a challenging problem. He is faced with an ever-changing situation; soil conditions are not the same throughout the trench as they were where the ditch commenced and the techniques must be changed accordingly. Many different methods are required and present ordinance requirements do not accord with the soils.

The question of soil classification and soil types is a very moot one. There are many classification systems. The most common classification, the one that is most widely used, is one based upon the particle size of the sample, the grain size. This system is relatively easy to use in classifying soils. It has the advantage of grouping soils into a general classification from which you might expect somewhat similar characteristics. This type of classification system, developed by the Bureau of Public Roads, is based on terminology of three soil fractions—sand, silt and clay. These sizes or fractions are defined in terms of the diameter of the particle.

To avoid details, but to give a general idea of the system: The sand fraction ranges from particles 2mm in size down to .05 mm; between .05 and .005 mm the term silt is applied to a particle; everything below .005 mm in diameter is lumped into the terminology clay. *(Fig. 1).*

The soil types or the terminology applied to the groupings are based on the percentage of these several fractions that are present in a given material. From that we derive a name for a soil group. The percentages of these fractions are set up in arbitrary classifications to yield group names or group terminology. Sand in this system is anything that contains 80% or more of particles whose diameter is within the range of 2 mm and .05 mm. A silt is something that has more than 80% of the silt fraction, and a clay has a rather broad range—generally anything that contains more than 30% of these very fine particles is termed a clay. Group names, such as sandy loam, silty loam, clay loam, etc., are assigned to soils having other combinations of the sand, silt and clay fractions. While these soil designations don't do a great deal for us, they do give a rough guide to the general physical characteristics of the material.

The physical characteristics of a soil are best determined directly by physical tests.*

But this particle size classification system overlooks a number of important factors that greatly affect the physical characteristics of soil and it is the physical characteristics that the engineer should be concerned with rather than arbitrary names or arbitrary tests. Important factors overlooked are the shape of the grains, which greatly affects the shearing strength, in particular, of soil. Density, of course, is extremely important to the physical characteristics. The gradation of the material also is important. So are the presence or lack of any cementing material and the mineral characteristics of the grains themselves.

All of these things contribute to the physical characteristics of soil but they are not included in this common classification system because if they were, it

*ASTM—Mechanical Analysis Test D422.

would not be simple, it would be extremely complex. So we use it simply for a way of giving a name to a certain material that is encountered in the field.

Now as to the field identification of these several types. It is not really a simple task. It takes quite a bit of practice to go out and pick up a specimen, smell it, taste it, rub it in between your fingers and say that this is a silty loam or a silty clay loam or something of that type. But one acquires with practice a feel for the thing and can come pretty close.

Fortunately, if you use the classification chart as outlined here, most of the time you are not concerned with an accurate, detailed classification. If you are, then the thing to do is to determine or measure the grain size. That is done in the commonly known manner of sieving the coarser particles and using the hydrometer method on the finer particles. There are certain crude field checks, however, that can be used as a general guide. For a sand, each individual grain can be identified by sight. For a clay, you can moisten it and squeeze it through your fingers and check its plasticity and cohesiveness and a few other qualities, so the clays are not too difficult to evaluate. The in-between sizes are where you get into trouble. Some of the textbooks give crude field identification tests that you can practice at home if you want to check soil characteristics in your locality.

The soils designated as clays cover a broad range in our terminology and there are many different types of physical characteristics within the clays, even though they all have certain similar general characteristics. The adobes are particularly troublesome in some respects. They have the quality of shrinking and swelling a great deal when their moisture content changes.

Now for something about the physical properties of soil. The engineer is primarily concerned with two basic problems. This applies to all engineering, not purely soil. The first, is the stability or strength and the second, the compressibility or deflection. The structural engineer, of course, first checks his structural members for strength and then rechecks for deflection. We must do the same thing with soils. Those two fundamental properties act independently of each other. In one case, one may control and in another, the other may control. The stability in soils is measured by the shearing strength of the soil. Basic laboratory tests have been devised and are being improved for measuring the shearing strength. The supporting value of a foundation—the load that it will carry before failure occurs—is dependent upon the shearing strength of the soil. The amount of deflection that will take place within the strength of the soil is independent of the shearing strength and is a function of the compressibility of the soil. Compressibility can also be measured directly and, once it is known, it is possible to compute within limits the actual deflection that will take place under a given loading. This word compressibility is further subdivided in the case of fine-grained soils or clays where the term consolidation is applied. So the shearing strength and compressibility of the soil are the most important characteristics with which the engineer must deal but actual measurement of these properties can be made and reasonably accurate designs and predictions can be based thereon.

The distribution of these stresses in the soil under load is shown in *Fig. 2*. The left side of the graph plots isobars of equal vertical stress; the right side shows isobars of equal shearing stress. With both of these characteristics the importance of the top portion of the soil immediately under the load is readily apparent. At a depth of one diameter of the loaded area the vertical stress is only 30% of the unit surface loading and it falls off markedly below this point. The shearing stress reaches a maximum of about 30% of the surface unit load from a point immediately below the edge of the footing to a point under the center of the footing and about one-third of a diameter below the surface. In effect then, the surface weight bearing portion of the soil is those layers down to about one load diameter beneath the surface. Soil below this depth merely requires enough compaction to support the weight of the soil above it.

The strength of soil is not a constant thing. It depends to a very important degree upon the moisture content of the material. The characteristics of all soils, except clean sands, are vitally affected by the moisture condition. You may walk in a field during the summer and find the ground surface baked hard and dry. After a rain you will go up to your knees in the material. This is particularly true with clay soils. When dry, clay can be almost as hard as a rock. When wet, the same clay will not sustain the most minor loads without flowing.

Other soil types indicate this same loss of strength and a corresponding increase in compressibility when wet. In other words, an increase in moisture produces adverse effects in two directions. It causes the soil to lose strength and it also causes it to increase in compressibility. The adverse effects decrease as the particle size of the soil increases. That is, the sandier the soil becomes, the less affected it will be by moisture.

In addition to the two basic properties that were mentioned—strength and compressibility—frequently expansion properties of the soil are important. This is particularly true for floor slabs, street paving and construction of that type. Some of the worst soils in this respect are the adobes of southern California, which may increase from 20% to 40%

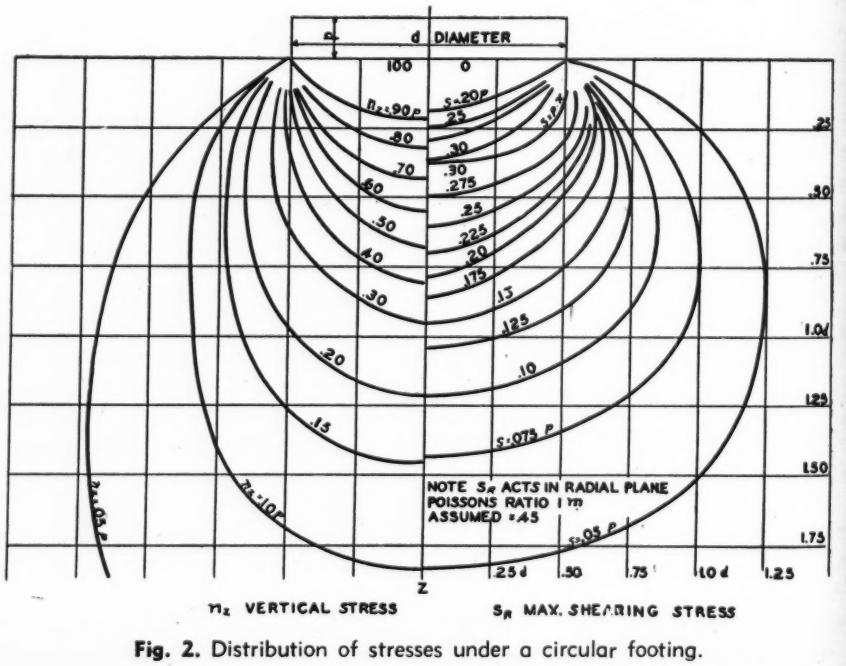
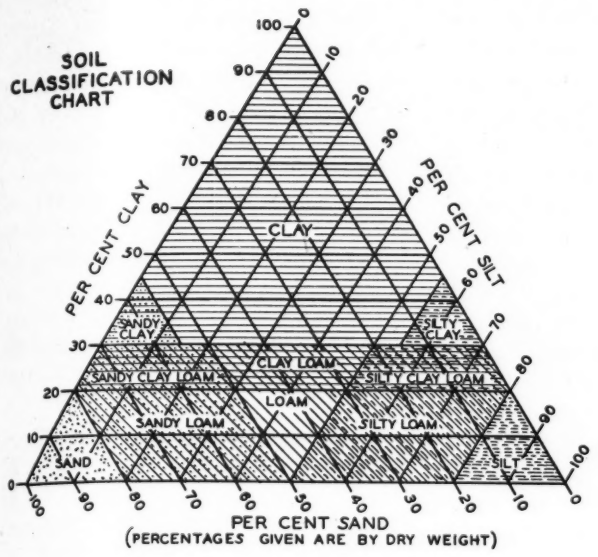


Fig. 2. Distribution of stresses under a circular footing.



SOIL FRACTION	PARTICLE SIZE			
	LOWER LIMIT		UPPER LIMIT	
	MM.	INCHES	MM.	INCHES
CLAY			.005	.0002
SILT	.005	.0002	.03	.002
SAND				
FINE	.03	.002	.25	.01
MEDIUM	.25	.01	.5	.02
COARSE	.5	.02	2.0	.08
ROCK FRACTION	THESE FRACTIONS ARE NOT CONSIDERED IN DETERMINING SOIL CLASSIFICATION.			
GRAVEL	2.0	.08	64.	2.5
COBBLES	64.	2.5	256.	10.
BOULDERS	256.	10.		

Fig. 1. Soil classification chart and key to test data.

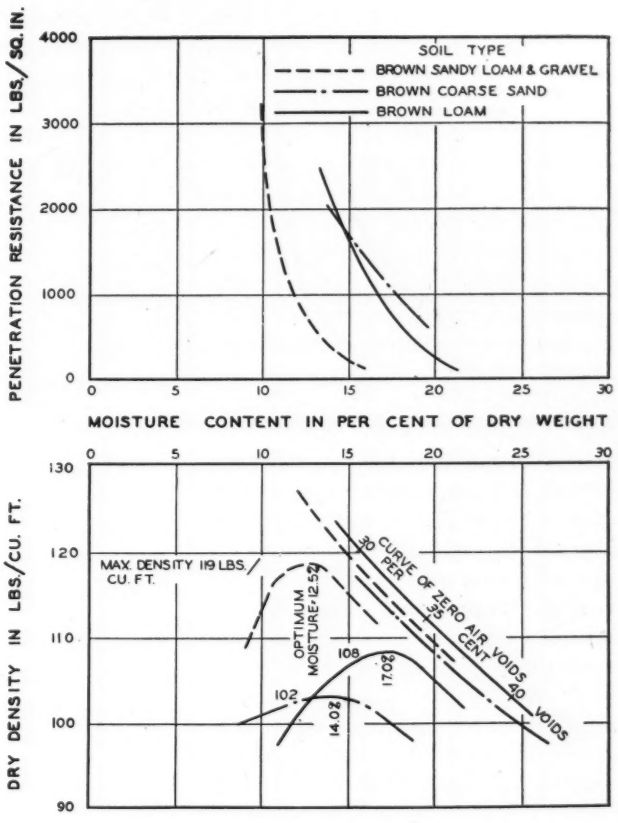


Fig. 3. Effect of soil type on compaction characteristics.

in volume with the addition of water.

So far the reference has been to undisturbed soil. In trench backfilling, of course, the engineer is dealing with soils in a disturbed condition—excavated material that is to be replaced. Naturally, he is concerned with the properties of the replaced soil. These same basic factors of strength and compressibility apply. The replaced material should be strong enough to support the loading that will be imposed and it should do so without permitting further yielding than can be accepted. Therefore, since loose material is low in strength and high in compressibility, the engineer is concerned with improving the properties of this soil as he puts it back in the trench.

This is where we come to the subject of compaction. Compaction is a method of increasing the density of a soil that is particularly applicable to loose materials that are to be placed in engineering structures. We know that the greater the dry density of a soil, the greater will be its strength and the less will be its compressibility. Therefore, the object of compaction is to improve the physical properties of strength and compressibility by densification of the soil.

Generally this compaction is accomplished by mechanically working the soil at the most advantageous moisture condition. Recent experiments show a great deal of promise in the use of vibrating equipment to obtain compaction, particularly for sandy soils. That is something contractors and others concerned in this subject should keep in mind and look forward to for future development.

There are a half dozen or so different compaction standards in common use. The development of compaction and its acknowledgment as a method of creating a soil mass that is equivalent to natural materials has made it necessary for specification writers to have some way of defining what they want in the field. These compaction standards were developed for that purpose. The original standards were what we today would consider as relatively low, but in recent years, the development of heavier and better compaction machinery has required the adoption of higher and higher standards. One of the basic reasons for selecting a higher standard is that contractors were extremely reluctant to bid on a job that required 100% compaction or more, even though that compaction could be readily obtained with modern equipment. In addition, it is desirable to have the laboratory method comparable to actual field results. So there has been a change in laboratory compaction standards periodically as contractors become more and more able to achieve greater compaction in the field.

The best known method of laboratory compaction at the present time is probably the AASHO (American Assn. of State Highway Officials) compaction test. The purpose of a laboratory compaction test is to determine the characteristics of a given soil when compacted. It will also indicate the amount of compaction that can be reasonably expected to be obtained in the field. All of the physical properties of compacted soils—that is the shearing strength, compressibility, expansion, and anything else you are interested in—can be predetermined in the laboratory in advance of construction. In this manner, the minimum degree of compaction that will achieve the desired result can be specified. To do any more compaction than that is a waste of money. To do less is to risk large maintenance expenditures. Unfortunately, it is commonly believed that many backfilling jobs are too small to warrant expenditure for soils engineering service.

Soils vary markedly in their compaction characteristics. For this reason, the compaction characteristics must be determined experimentally for each type of

soil. Typical compaction curves for three soil types are shown in *Fig. 3*. The lower graph shows the relationship between the dry-weight density and the moisture content when the soil is subjected to a standard compaction effort. The upper graph shows the relationship between moisture content and the resistance to the penetration of a plasticity needle.

To establish the moisture-density curve, a series of tests must be made. For each test, a soil sample is placed in a standard container and compacted in a specified manner. The sample is then dried and weighed to determine its moisture content and dry-weight density. The test is repeated several times with the same soil with the moisture content increased for each test. The compactive force, of course, is held constant. The resulting curve shows the maximum density, in terms of dry weight, that can be obtained with a given compactive force. The effect of moisture on this result is shown by the shape of the moisture-density curve. The moisture content at which maximum density is obtained is termed "optimum moisture content." For the coarse sand (the lowest curve), moisture has relatively little effect on the density obtainable. On the other hand, moisture content is a critical factor with the sandy loam shown on the upper curve. A relatively small difference in moisture content results in a substantial difference in the density obtainable with a given compactive force.

The maximum density obtainable in such a standard test at optimum moisture content is the reference point in compaction specifications. The compaction to be obtained is generally expressed as a percentage of this so-called maximum density. It should be pointed out that this density is not the greatest that could conceivably be obtained—it is simply the maximum density that results from the specified laboratory compaction procedure.

The other curves on *Fig. 3* are of less direct interest to the excavator. The zero air voids curves on the lower graph give the soils engineer a check on the accuracy of his moisture-density curve, and also provide an indication of the additional moisture that the soil can absorb before becoming saturated.

The penetration resistance curves in the upper graph may at first glance lead to some misleading conclusions. These curves show the resistance of the soil to the penetration of a standard needle, at various moisture contents. As might be expected, the drier a soil is, the greater its resistance to penetration; as the soil approaches a saturated condition, its penetration resistance rapidly approaches zero. It might appear desirable to compact the soil at a low moisture content since penetration resistance at the optimum moisture point is substantially lower than at lesser moisture content. However, should the moisture content of the soil increase after placing, which is customary, the penetration resistance would be reduced correspondingly. Soil at maximum compaction will lose less of its strength with additional moisture than will soil less densely compacted.

Up until recent years, municipalities and utility companies and others concerned with digging and backfilling in city streets, accepted the idea that constant street maintenance was a necessary companion of trench backfilling operations. This has undoubtedly been fostered by a background of many years of backfilling in an inadequate manner and by antiquated ordinances regulating the backfilling of trenches but what was good enough in the days of the horse and buggy is definitely not good enough in these days of heavy vehicular traffic. In addition to the requirements of public safety and convenience, economy requires that the job be done in a modern manner for there is no economy in the antiquated methods that sufficed in our grandfathers' day. To be sure, first costs may be less, but every thinking man recognizes that low cost is not the complete measure of value. Upkeep and maintenance costs frequently reverse the economic picture.

The basic requirement of backfilling is a very simple one—merely to fill up a hole that has been made in the ground. In many locations the operation has no other function but in an urban area, the filling must be done so as to achieve certain desirable results. First, the backfilled trench must support the loads to be imposed in a satisfactory manner. That is, the backfill must possess adequate strength and deflection characteristics to meet the requirements of its usage. Those can be established and the necessary characteristics of the backfill predetermined. Second, the backfill trench must be a sound economic investment. It should cost no more than the minimum amount necessary to achieve the required structural performance. Third, the backfilling should be done with the least inconvenience to the public, which usually means in the shortest possible time. This third requirement does not have to be inconsistent with the one of economy.

Now let's give a little thought to common practices in backfilling operations. Backfilling today is generally governed by ordinances that do not consider the soils with which the excavator must deal. The soils pay no attention to man-made laws and perform exactly in the way nature intended them to. Present day backfilling practices range from dumping dry soil in a ditch to the slightly more enlightened practice of flooding or jetting. In a very few instances, recognition has been given to the process of compacting the backfill by mechanical methods.

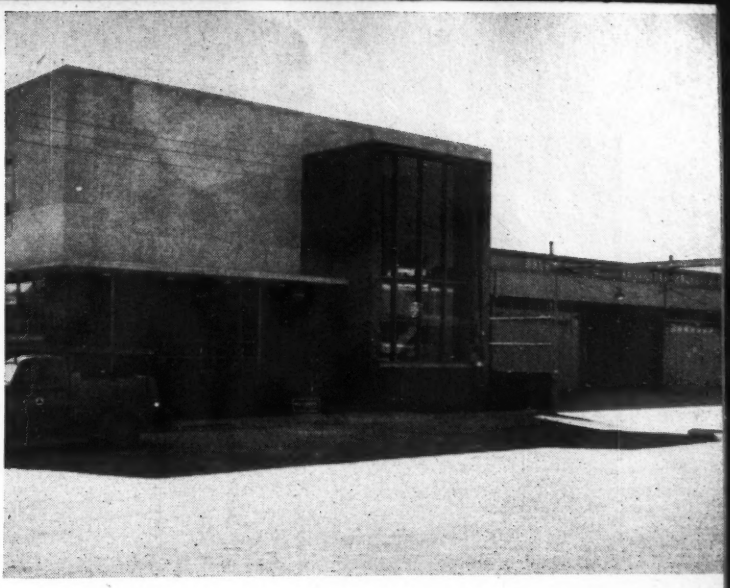
Dumping dry backfill in a ditch is a waste of time and money except, of course, in a location that will not be affected by the works of man. Flooding the backfill is not a suitable method unless you can afford to wait several years for the backfill to settle and obtain the necessary stability, or unless you are prepared to go back and make continued and frequent patching. It is often pointed out that flooding or settling by water is nature's way of depositing soils. That is true, but nature took a great many years to make all of these soil deposits that we see and live on. If we want to wait that long, the same thing can be done with backfill.

The soils engineer is afraid to use flooding—around foundations particularly. This doesn't apply as strongly to trench work but there are many cases where the natural materials will be in a dry state and pouring water into them may be just the wrong thing to do. The one exception is where the backfill material is a clean sand and the trench itself is made in sandy soils. But even the flooding of sand should be done with caution for trenches on main arterials.

It is my prediction that within a few years all important backfilling will be done by compacting the backfill in the trench. The development of modern equipment especially designed to do the job is rapidly reducing the cost of this operation. An effective backfill means immediate repaving of the trench surface, restoring the street to traffic and eliminating the expense of temporary pavement maintenance. I don't believe that municipalities and utilities will continue to accept much longer the inadequate measures that they have been content with up to now. The techniques and equipment are ready. It only remains for the responsible parties to recognize their merit and avail themselves of the means.

This article was prepared from a recording of a talk given at a meeting of the American Public Works Assn.

GAS report



Front of the new Dallas service center recently opened by Lone Star as part of its decentralization program.

New service center opened by Lone Star

COMPLETING a three-year planned program of decentralizing distribution operations in the Dallas metropolitan area, Lone Star Gas Co. recently opened its newest service center in the Oak Cliff section of the city.

The new center is the third to be established in Dallas and will serve some 50,000 customers west of the Trinity river, which divides the city. Its completion provides the company with three zones of operation in the city for service and maintenance as well as main construction and warehousing.

The new plant is on a 4½-acre tract in the heart of the area it will serve. Two buildings have already been completed, a combination office and warehouse building and a small building housing waiting rooms for street crews, and the site affords room for the addition of two more buildings. A 295-ft loading dock completely enclosed and heated will handle heavy loading.

Main building is two stories over the office section and provides a 14-ft minimum clearance for the warehouse. In the office section is a second floor lobby stairway, accessible without entering the office proper, and leading to an auditorium, kitchen, and locker and shower rooms. There is also an auditorium stage, which will afford a model kitchen display.

On the first floor are supervisory offices, a reception room where servicemen may write up orders and check in, a conference room and the main shop, street and warehouse office.

From the second floor auditorium a back stairway leads down to the loading dock in one direction and to a warehouse balcony in the other. The balcony is equipped with a metal gate that can be opened to facilitate delivery and removal of gas appliances for the auditorium stage and the kitchen. With the use of a fork truck such units can be lifted mechanically from the warehouse floor to the balcony and then into the second floor rooms.

The steel and masonry office section is finished with face brick and cut stone. Wide plate glass windows between the reception room and the lobby afford clear vision in and out of the offices. Plate glass windows two stories tall light the lobby stairs.

Fixed sash windows were used in the office building, which is air conditioned with a 25-ton Servel unit. Also in the equipment room are three Ready Power electrical generators for all building requirements. One of these is a 10-kw standby unit and two are 35-kw units.

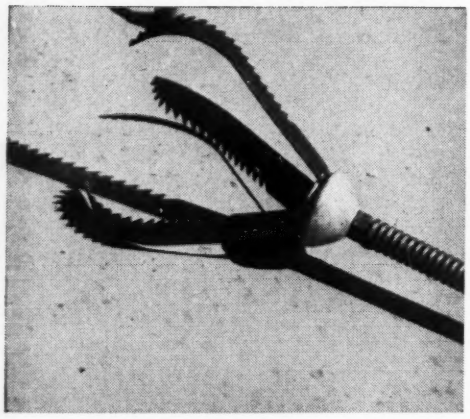
Under construction at present is a third building that will provide storage and handling of heavy duty automotive equipment and maintenance and repairs. All automotive units will be kept inside at night either at the loading dock or in the garage area.

The warehouse, one-third larger than the company's new North town center, is equipped with a special paint room and a gas-fueled Mourse-Bolger Destructor, which will handle 480 lbs of dry rubbish per hour.

The new center will be headquarters for some 128 employees, including street crews, warehouse, shop, street and garage personnel, with a central office pool of clerical and supervisory employees for each department.

Radio equipment, already established in the Dallas distribution area, will be beamed for Oak Cliff service as well and coordinated with the other service centers and the main office.

View of the warehouse showing the overhead windows installed to give maximum lighting. Area has 14-ft minimum clearance.



Close-up of the flexible steel cutter blades.

GAS exclusive

Citizens Gas uses unique method for cleaning mains

DURING the many years the distribution system of Citizens Gas & Coke Utility, Indianapolis, has been in use (gas service in Indianapolis dates back to 1852), many of the older mains have accumulated deposits of scale and dirt from manufactured gas. These impede the flow of gas and also cause stoppage of pilots and controls if carried with the gas.

Consequently, steadily mounting gas send-outs made it imperative that the company start a program of overhauling many of its older mains and services as well as bolstering up the system with tie-ins and additional feeder mains.

The first method of cleaning used was to isolate a section of main, usually about 300 ft. By means of an air compressor, each service line would be cleaned by blowing the dirt and scale back into the main. In extreme cases pressure and vacuum were used alternately to break the scale loose. Then with the services cleaned and the service curb stop closed, a quick-opening type valve would be installed on one end of the section and up to 100 lbs of air would be compressed in that section. A sudden opening of the valve would allow the pressure to drop suddenly, thereby loosening up and blowing the loose scale and dirt out of the main. This process was repeated until the main was free of all foreign matter.

While this method was effective, it had many disadvantages. For example: danger of breaking the main with the higher pressures (these breaks would have to be located before placing the main back in service) and the objection to the dust blown into the air in spite of the fact that every effort was made to confine it to bags or drums.

Through the ingenuity of several street department foremen, the company devised a method that not only overcomes the objections of the pressure method but also produces a better cleaning job at less cost. Principally the method consists of running a sewer-type cleaner through the main while a vacuum removes the loosened scale. During the early use of this method the company rented equipment of the Roto Rooter Co. and the Holland Furnace Co.; later the company purchased its own equipment.

With this equipment, the procedure is as follows:

1. Each service on the section to be cleaned is cleared by blowing the scale back into the main. The compressor-mounted trucks are so equipped that vacuum and pressure can be applied alternately to the service to loosen the scale. The curb stop on each service is dug up and renewed because many of these are old brass stops that will not hold sufficient pressure to insure a good pressure test on the service after cleaning.

2. The section of main to be cleaned is isolated. Usually the section is 600 to 700 ft in length, depending on cross connections, condition of the main, etc.

3. The vacuum truck is connected to one end of the section as shown in the picture. The main is connected to the suction side of an engine-driven blower with a 10-in. rubber hose and the exhaust side is connected to a trap and the dust bag. The blower is capable of pulling a 50-in. wc vacuum.

4. The Roto-Rod machine is stationed at the other end of the section. This machine is equipped with an 1100-ft steel rod driven by a small gasoline engine. A brass pilot head is attached on the end of the rod and inserted into the end of the main.

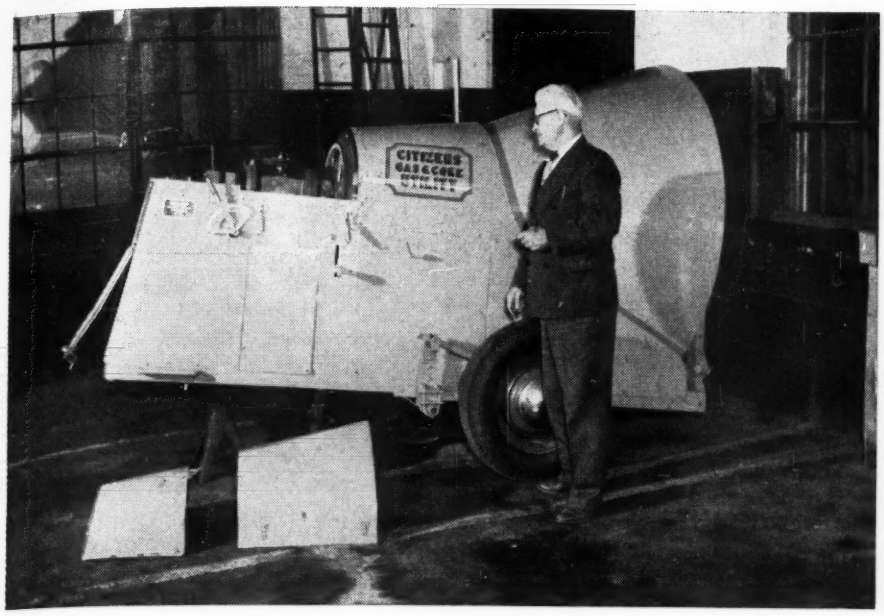
5. The Roto-Rod machine feeds the rod into the main at the rate of about 15 ft per minute. When this is started the blower on the other end of the main is also started, pulling out the loose scale as it is loosened by the pilot head. Centrifugal action of the head causes it to wheat against the walls of the pipe. A counter on the Roto-Rod gives the location of the head at all times.

6. When the pilot head reaches the other end of the section it is removed and a flexible steel cutter blade is installed on the end of the rod. The vacuum hose is reconnected.

7. The Roto-Rod machine revolves the cutter as it is withdrawn back through the pipe, the vacuum pulling the loosened scale from the pipe.

8. Generally these two passes will clean all scale and dirt from the pipe. If necessary, additional passes are made with the cutter.

9. The main is reconnected and service restored to the customers on the section. The actual cleaning time involved is very small—usually a 600-ft section of 4-in. main can be cleaned and placed in service within three hours after the services are cleaned and excavations made. In some cases, before the rod has been in



Frank Weber inspects the Roto-Rod unit in the district garage. One crew, using this machine, recently cleaned 600 ft of mains within a 2½-hr period.

serted the full length it is necessary to stop the operation to clean the dirt out of the traps, one of which is located at the end of the main and the other at the entrance of the dust bag. The company has cleaned as much as 50 gals. from a 600-ft section of 6-in pipe. It is not uncommon to remove such things as tools, stones, timbers, etc., that were left in the main when it was originally installed. In event a complete hard stoppage is encountered by the pilot head, the location is noted on the distance counter and an excavation made to remove the section where the stoppage exists.

The Roto-Rod machine is a standard machine made by the Roto-Rooter Co. of Des Moines, Iowa. The vacuum equipment is home-made, consisting of a 5-ft, 7-in. blower driven by a Ford engine. It is equipped with suitable controls in order to prevent damage to the dust bag by excessive pressure. It is similar to the furnace cleaning equipment used by a number of furnace cleaning firms.

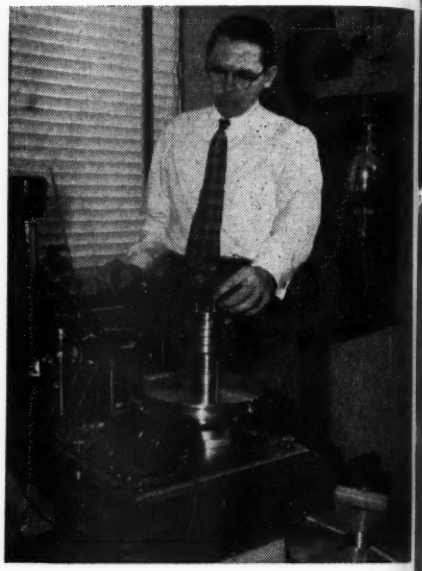
This method is not only more economical and more efficient than the previous method, it is less hazardous than the pressure-blowing method and does not result in customer complaints.

The Roto-Rod (above) unwinds the cable as the cone-shaped drum revolves and the cutter blades twist through the main. The heavier particles loosened by the blades fall into a trap and the rest are drawn through a tube (left) by a truck-powered centrifugal blower and collected in a vacuum dust bag.

GAS exclusive

Junior engineers in Columbia Gas System's Pittsburgh group compare station numbers with a right-of-way survey. In the background a sideboom cat holds a joint of pipe while the men stovepipe it

Columbia Gas develops engineer training programs



Promoted from junior engineer, a gas measurement engineer takes readings on a dead weight pressure gauge.

COLUMBIA GAS, like thousands of companies in expanding industrial fields today, is faced with a shortage of engineering talent. The incredible demand for natural gas which has developed since World War II has been paralleled by a like demand for engineers to expedite the tremendous expansion.

In order to fill its engineering quotas, Columbia Gas System has worked out an aggressive recruiting program. And to provide a thorough working knowledge of the industry so that each young engineer's talents may be best utilized, the company has developed an efficient engineer training program.

The system's two-year-old recruiting program is spearheaded by an eye-catching recruiting brochure, which is sent to more than 100 colleges in and near Columbia's operating territory. The brochure, written in question-and-answer form and geared to student problems, is followed up by campus interviews conducted by a member of the employee relations department, or sometimes by someone from the engineering department.

Interested students with proper qualifications are invited to Columbia's offices for interviews with both the employee relations department and engineering department heads. All graduate engineers hired are enrolled in the engineer training program.

Columbia Gas really has four training programs, the oldest being that of Columbia Gas System Service Corp.'s gas engineering department, which has headquarters in Columbus, Ohio. Like Topsy, that original training program "just growed" as new engineers were absorbed by the department. They had to learn the gas business quickly and thoroughly, so they were sent out with senior engineers to help with a variety of jobs throughout the system. Gradually the engineer training program was developed.

The training programs of each of Columbia Gas System's three natural gas operating groups, with headquarters in Columbus, Pittsburgh, and Charleston, W. Va., are patterned after that of the gas engineering department, with modifications to fit the varying needs of each.

The service corporation's engineer training program differs from those of the groups in that its trainees travel throughout the system, working in the various groups as the need for engineering assistance arises. Group trainees remain within their own groups. At the end of the training period, service corporation trainees may be offered a job anywhere in the system. Permanent

assignment for group trainees is within their own group.

Here is a sample of how the service corporation training program works: Recently one of the gas engineering department engineers-in-training was sent to Charleston with a senior engineer to assist in a special rush job involving stress relief operations. They remained a week, working with a contractor from 8 to 20 hours a day to finish the job. At the same time another gas engineering department trainee was sent to the New York office, home of the parent company of the system, to work on gas procurement problems. From there he went to Houston to assist a service corporation vice president who was attending a meeting of the national safety code committee concerning cross country pipelines.

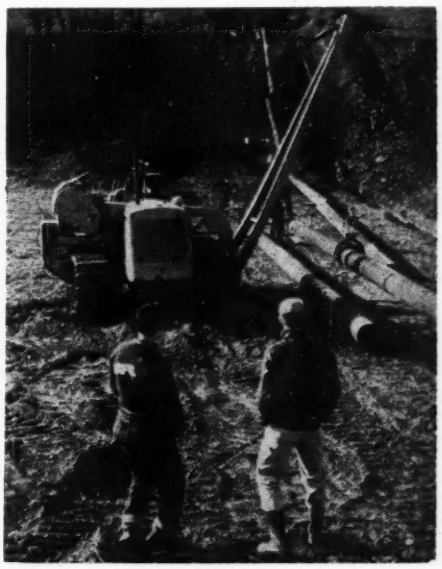
During that same period another young engineering trainee was sent by the gas engineering department to work with Columbus group engineers on leakage detection right in metropolitan Columbus. One of their projects was to seek the cause of an explosion. The answer was simple: a local contractor had been using lighted matches to find a gas leak. While working with the measurement and distribution departments of the Ohio Fuel Gas Co., the trainee observed installation of distribution lines in city streets and country lanes. He also worked in the meter repair shop, actually making repairs and checking diaphragms.

That is typical of the engineer training program: the trainees not only get around, either within their own groups or throughout the system, but they get their hands dirty. They take meters apart and repair them; they help on construction jobs; they learn about arc welding by trying it and about communications by repairing and helping to install mobile radio units. On compressor station duty they often start in the housecleaning department—scrubbing oily floors. Later they are assigned to "running tours" with the oiler. The junior engineers assist with a variety of tests such as street main pressure drop tests, field tests of displacement meters used to measure large amounts of gas sold to industries or purchased by the company, corrosion mitigation tests, and many others.

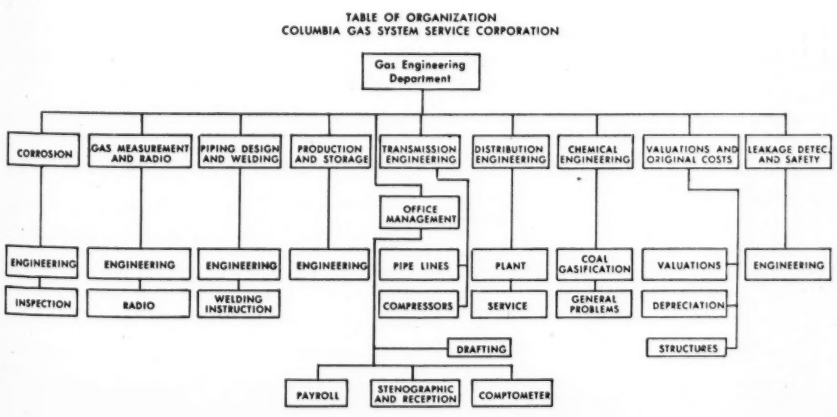
Some of the training is necessarily by observation. Since the object of the engineer training program is to teach the junior engineer every phase of the natural gas industry, he observes when it is not feasible for him to participate. He learns how the home service, information, methods, rates, legal, budget and employee relations departments operate by spending anywhere from a few hours to a few days observing each of them and discussing their duties with department members.

Columbia wants all of its engineers to be well-rounded and thoroughly familiar with every angle of the gas business. The company believes in giving its young engineers the opportunity to try every type of engineering work done within the system in order that they may best understand their own aptitudes and prefer-

A cadet engineer on duty with the distribution section of the gas engineering department uses a slide rule calculator to solve problems of distribution piping design and check capacities of existing lines.



Two junior engineers watch as a sideboom cat lines up a section of pipe near a river crossing at Donora, Pa.



Million-dollar musical road show introduces Servel's 1953 line

A million-dollar musical extravaganza, unprecedented in the introduction of industrial products, went on the road last month to announce Servel's 1953 line of appliances to dealers coast to coast.

Two road companies will take the "1953 Show of Stars" to 30 cities. Simultaneous premieres were held in New York and Boston on Jan. 21.

The company has engaged top professional talent to produce a show for dealers that will rival anything available to the general public.

W. Paul Jones, Servel president, emphasized that the million-dollar production is in addition to the record-breaking $6 million advertising budget with which Servel is backing its new products in newspapers, magazines, radio, and television in 1953.

The line that is to receive this national showcasing stars the revolutionary "Ice-Maker" refrigerator, which makes ice without trays. It also includes new furniture-styled window-type room air conditioners, horizontal and upright home food freezers, and electric compression refrigerators. The portable electric Wonderbar, introduced last August, also will be shown.

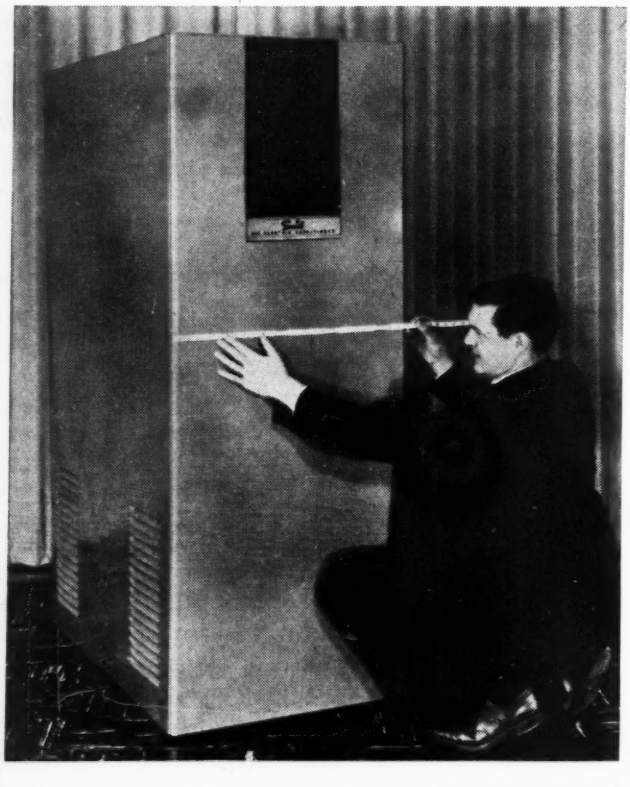
The five-hour show was assembled by Max Richard, a leading Broadway producer. It is a full-scale musical production, traveling in private railway cars and playing the largest theaters of the cities it will visit. However, tickets to all performances will be confined to company distributors, dealers and utility representatives.

At the same time, Servel announced that its new line will include all-year air conditioning for homes in the price range of $10,000 to $14,000. The company will market a new, 2-ton gas fired unit capable of providing summer and winter air conditioning for an average six-room home.

This new 2-ton air conditioner is direct-fired and performs every function of all-year air conditioning for homes of the $10,000 to $14,000 bracket containing up to 1200 sq ft of floor space. It requires only 8½ sq ft of floor space and is 75 in. high. Its gas-operated absorption unit provides the needed quietness of operation, long life, and low installation and maintenance costs. It will be delivered to dealers in the spring.

John A. Gilbreath, assistant vice president in charge of air conditioning, told distributors at the firm's second annual air conditioning sales convention that the firm planned to boost output of all air conditioning units 300% over 1952 production to meet the expected demand.

Also unveiled was a 10-ton water chiller for industrial installations, a smaller version of the 25-ton model already available. At the same time a substantial reduction in the price structure of the 3-ton residential unit was announced.



Compactness is the outstanding feature of Servel's new 2-ton residential air conditioner aimed at the small home market. The unit measures 27 in. across the front, stands 75 in. high, and takes up only 8½ ft of floor space.

ences. The program also gives the company the opportunity to observe these young men and to use its judgment about where they fit into the pattern. A system of grading by each department head under which the engineering trainee works provides a complete record of each man's engineering abilities, personality, habits and possibilities. A careful study of this record is made before the junior engineer is assigned to a permanent job.

There are two strict rules that are never broken: no engineer-in-training replaces a regular employee and no trainee is assigned to a regular job before he has completed his training program.

The program is necessarily flexible for the men may be taken off one phase of training temporarily to take advantage of opportunities such as attending a seminar at a nearby university, sitting in on a supervisory meeting, or observing installation of a new compressor unit.

In the Pittsburgh group, two engineers-in-training were sent to the University of Pittsburgh in November to attend a two-day industrial conference on lubrication sponsored by the American Society of Lubricating Engineers. In Columbus, junior engineers frequently work with the research staff at Battelle Memorial Institute on research projects sponsored by Columbia Gas System.

Two junior engineers in the Charleston group recently studied gas well fire-fighting methods at first hand when a brown shale well unexpectedly came in at extremely high pressure and caught fire. The trainees worked with the fire-fighting crew which brought the flaming geyser under control. Fortunately for the system, not every junior engineer has this opportunity.

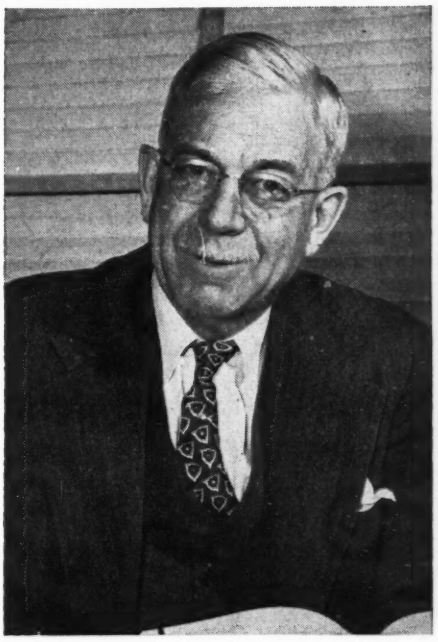
Columbia's training programs last from 10 months to a year in the groups and approximately two years in the gas engineering department of the service corporation. It takes from three to five years to season a young engineer to the point where he can handle an administrative job under general supervision.

With an active recruiting program and an intensive and complete training program now set up and operating smoothly, Columbia Gas System hopes that within five years it may catch up with its engineering needs—that is, if the growth of the natural gas industry levels off a bit. But if the industry, and Columbia along with it, continues to expand as fast as it has in the past few years, who knows when the quota will be filled?

GAS exclusive

Tom McGrath

Ace lobbyist for the coal interests and No. 1 hairshirt of the natural gas industry



WHEREVER and whenever natural gas leaders—executives, attorneys, engineers or geologists—congregate, sooner or later someone is bound to remark: "Now, if we could just figure out a good way to get Tom McGrath to lay off the natural gas industry . . ."

This is said good-naturedly, of course, for natural gas men long since have given up hopes of getting rid of Thomas Joseph McGrath, who, in his early 60's, is proud of his reputation of being the No. 1 hairshirt of the natural gas industry.

Mr. McGrath, or "Tom," as he is universally known to friend and enemy, spends most of every day at the Federal Power Commission, intervening in every possible case in an effort to prevent natural gas from encroaching on the province of coal. And he has been notably successful in more than one instance in putting the crimp into well-laid plans of natural gas executives to lay new pipelines or to develop new off-peak customers. Not so many years ago, he singlehandedly stopped a large company from making a contract with the Tennessee Valley Authority to sell that agency gas in the summer for boiler fuel. He also was able to prevent the use of gas as a boiler fuel in the Cleveland, Miss., plant of the Mississippi Power & Light Co. and, in another case, in five generating plants of the Duke (N. C.) Power Co.

He never misses an opportunity to speak in "the public interest" against the natural gas industry. In fact, after hearing him talk about the public interest for hours before the FPC one is liable to assume that McGrath is being paid by the public.

But this is far from the truth. The companies and interests that pay McGrath include the National Coal Assn., which represents the very largest coal operators; the United Mine Workers, the Railway Labor Executives Assn., and the Fuels Research Council Inc., which consists almost wholly of Eastern railroads like Norfolk & Western, Chesapeake & Ohio, Pennsylvania, etc., whose principal sources of income just happen to be derived from hauling coal.

Mr. McGrath has pointed out before the FPC again and again that, in his judgment, natural gas is encroaching on the coal interests to "a dangerous degree."

For example, he recently introduced an exhibit showing that in 1920, bituminous coal met 71.8% of the nation's fuel needs, while anthracite met another 11.7%. Today, his statistics show, bituminous coal is supplying only 46.7% of the nation's fuel needs, while anthracite supplies only 3.9%. In 1920, natural gas supplied only 4.35% of the nation's fuel needs, while today, according to his statistics, it supplies some 22.5%, or more.

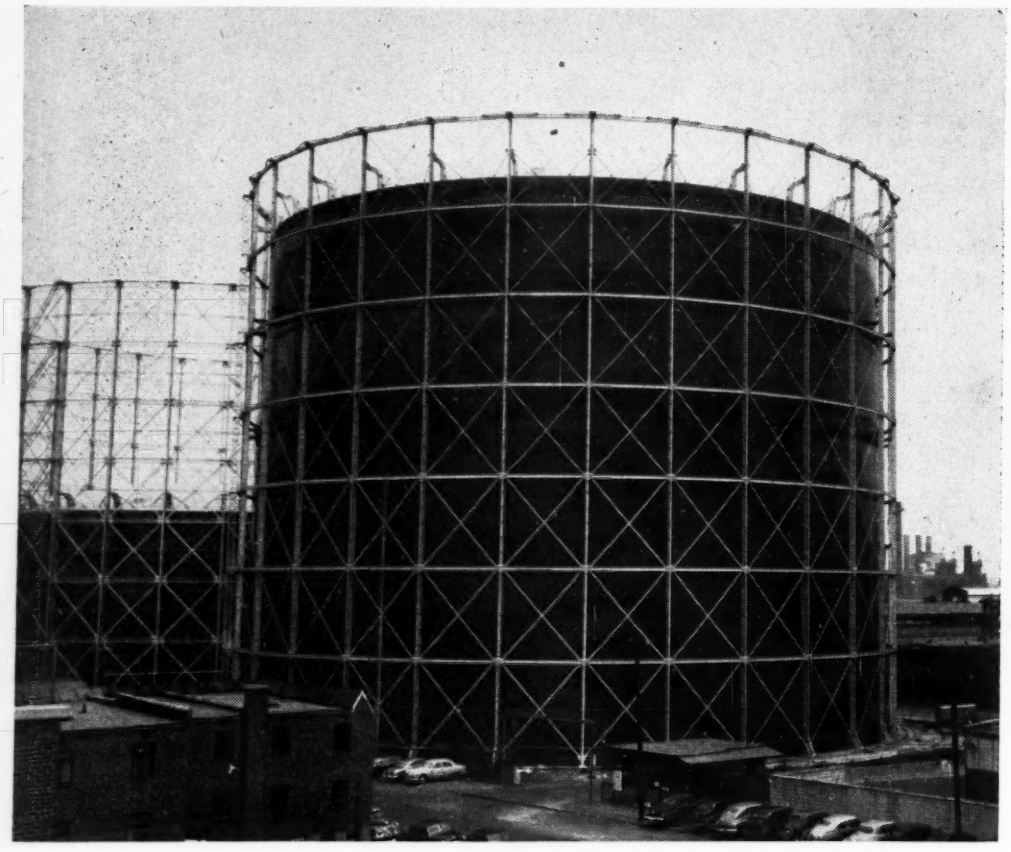
At the same time, McGrath constantly views with alarm what he calls the "diminishing reserve picture as to natural gas." He points out that in 1946, there was an estimated life of natural gas reserves of some 32.49 years. Yet, in 1951, according to his figures, the estimated life of natural gas reserves was only 24.32 years. He believes, or says he believes, that there will be no natural gas left to speak of in the U. S. in another 20 years or so, and that people and industries who have invested billions of dollars in natural gas appliances or materials will be bemoaning their shortsightedness.

McGrath is not registered as a lobbyist, and does not have to be as long as he does not go to Capitol Hill and actually buttonhole congressmen, but, of course, he meets congressmen at various functions and is always ready to put in a good word for coal and a bad word for gas. He is a typical lobbyist except that he is more energetic than most. And the proposition pays extremely well; some estimate that McGrath makes $100,000 a year or better.

A genial and likeable fellow, for all his viewing-with-alarm, McGrath practiced law in St. Paul for some years and in the early '30s, became general counsel for the Brotherhood of Railway Trainmen. He had occasion to come to Washington on numerous occasions to testify before the Interstate Commerce Commission for that union and other rail interests. In the late '30s, he became very interested in opposing the St. Lawrence seaway project and related projects, and became attorney for the rail and other interests who were determined to stop this development. He was successful, and when the late Franklin D. Roosevelt dropped this project, he opened law offices in Washington. In 1942, the Railway Labor Executives Assn. asked him to start watching gas matters at FPC "for a couple of months." That was a decade ago and he has had only one vacation since that time.

Tom McGrath is likely to continue being the natural gas industry's No. 1 hairshirt for a long time to come. The interests he serves are well satisfied with his work. He even went up to Canada last summer to become an expert on Canadian gas matters so as to try to stop the construction of the contemplated new pipeline into the Pacific Northwest. This is far out of his territory, but he feels that it is his duty to serve the "public interest" of America as long as the coal interests will pick up the tab. And that seems like a long, long time to come.

GAS exclusive



Flotation method painted this huge 15-MMcf gas holder, one of the world's largest, at the rate of 69,000 sq ft an hour.

ConEd's flotation method paints huge gas holders in record time

DURING the past nine years Consolidated Edison Co. of New York Inc. has developed a "flotation" method for painting the submersible surfaces of water-sealed gas holders. The method, which grew out of a search for a way to get a better paint job, has more than justified itself both in reduced cost and less maintenance as well as in making more efficient use of manpower. Even though more and costlier paint is required, the five-year cost of flotation painting, based on performance experience, is only 36% of any other known method.

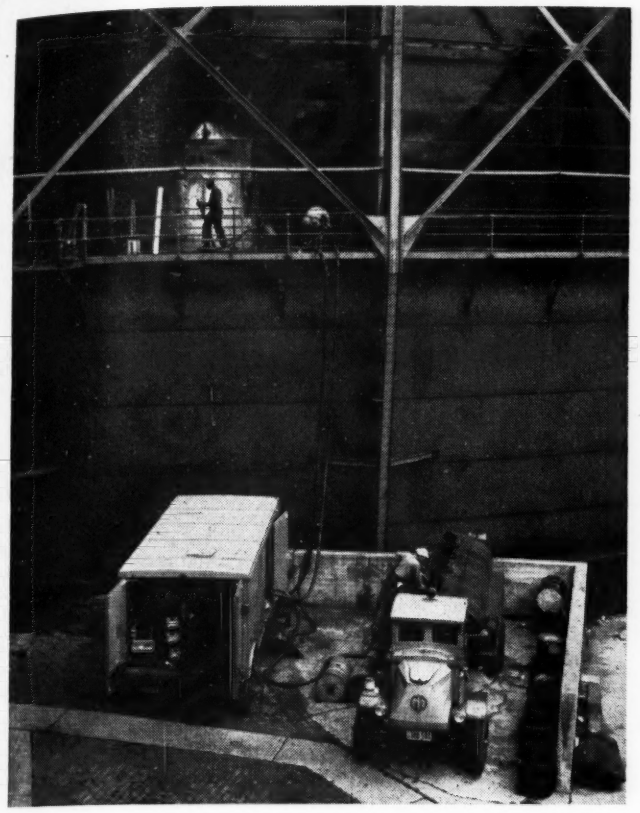
The method is simplicity itself. Paint floated on the water seal of an inflated lift is forced against the lift by hydraulic pressure as the lift descends. After submersion the lift is inflated and an even coat of paint adheres to the holder surface. Any excess paint flows back on top of the water seal and is pumped off for reuse. The movement of the lift is controlled by the pumping and valving facilities of the particular installation.

The elements of the method are not so simple. They are the result of careful experimentation, manufacture, and measurement. The paint employed must be of controlled viscosity and specific gravity. The paint now used has the appearance and toughness of cordovan leather with a further advantage that yellow oxide picked up by the holder from the water is not particularly noticeable.

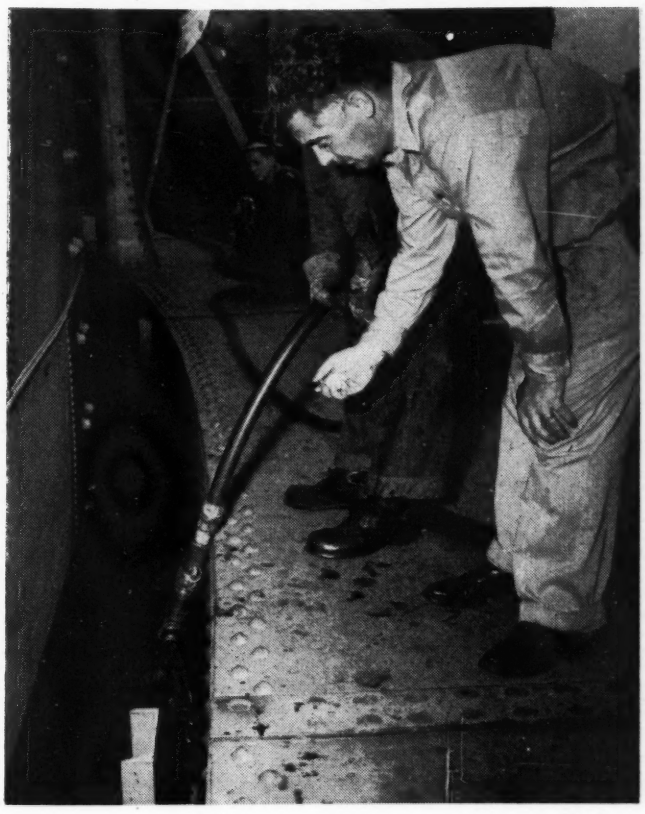
Application of the paint must be done with care. The paint is brought to the holder by tank truck and is pumped electrically from the truck through a portable 2-in. hose ring, fitted with fast couplings. There are 10 circumferential outlets for the average gas holder. The ring line rests on the walk that skirts the water seal. Paint is pumped through one outlet at a time to control the pumping capacity against time that is checked with a stop watch. This assures an adequate and even distribution of paint on the water seal. A further check is made by means of a special gauge that sinks through the paint but floats flush with the water level.

When the required amount of paint has been distributed around the seal, the lift is lowered, drawing a "curtain" of paint down with it. The paint crew watches carefully to check thin spots in the paint resulting from wind pressure or faulty loading and any deficiencies are eliminated by adding more paint. When the lift reaches the limit of descent, the gas flow is reversed causing the lift to rise. The excess paint is pumped off the surface of the water back into the tank truck. If any water is included in the return to the tank truck, it is either drained out of the bottom of the tank or pumped into another cup where the paint and water separate naturally.

The flotation method of painting provides automatic impregnation of the old



ConEd's flotation paint rig. The 1500-gal. tank truck at right picks up paint at supplier's, eliminating packaging. Paint is sent by pumps in trailer at left up through riser to water seal.

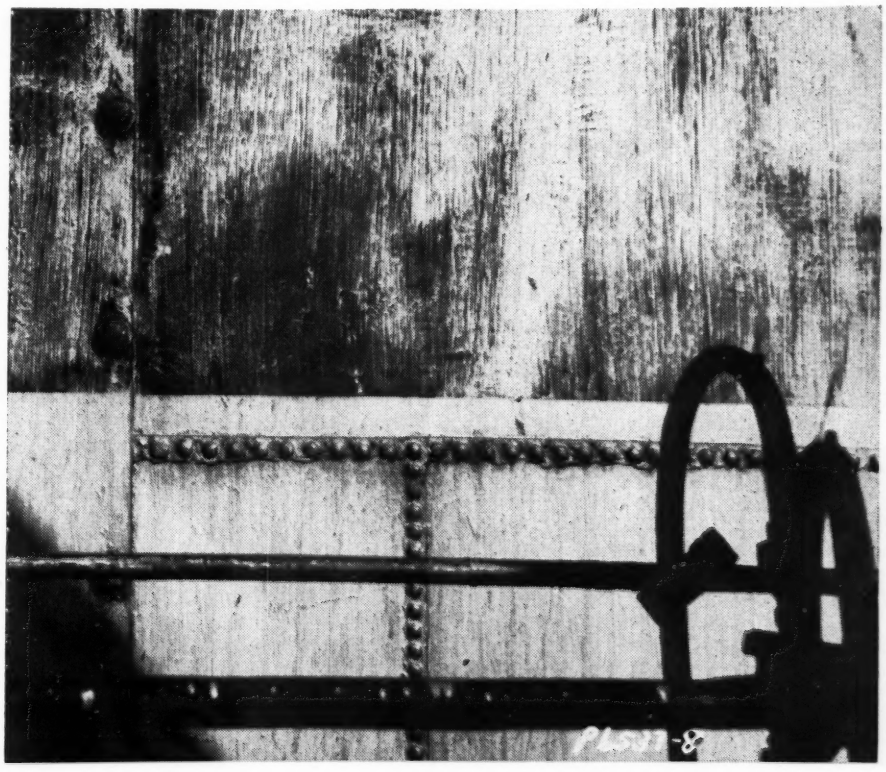


Paint being loaded on water seal. Foreman with stopwatch, calibrated to pump performance, sees that predetermined gallonage is poured.

surface, automatic and even distribution of a wet film after absorption requirements have been met, and a wet film four to six mills thick without runs or sags. The completed job avoids skips or misses, half painted rivets, air bubbles and other common mechanical causes of paint failures. Experience has demonstrated that flotation applied paint lasts two and one-half to three times as long as paint applied by any other method.

ConEd has now done 31 paint jobs on its water-sealed holders by the flotation method. The six-man crew working a normal schedule can paint the submersible area of a gas holder in less than three days, including all setting-up and taking-down time. On ConEd's 15-MMcf holder, with a rising rate of 15 in. a minute, the paint can be applied over 69,000 sq ft in an hour. That is like painting the floor of a room 24 ft square in about 30 seconds.

The patents covering the flotation method are totally owned by Consolidated Edison but the company will on application license any utility, royalty free, to use the method.



Same paint, different method after a few years of exposure. Upper section was painted by conventional brush method; bottom by flotation.

Gas saves pla%

By ROBERT B. RICHARDS
Kings County Lighting Co.
Brooklyn

These large glass areas give excellent visibility for working but cause high heat losses in the shop. Suspending the heaters from the ceiling saves valuable floor space.

WHEN Vahl Engineering Co. commissioned Brown & Matthews Inc. to build a new manufacturing plant for them in early 1951 at 6401 Second Ave., Brooklyn, they asked the builders to consider most carefully the matter of heating this new plant. Vahl Engineering is a commercial machine and tool shop producing machine parts in steel, aluminum and alloys for aircraft, and other products with exacting requirements. The partners in the concern insisted that the facilities of the plant be consistent with the quality of product it was intended to manufacture. Current construction costs, however, are a big factor and they wanted to make sure that all possible economies were made, without impairing the high quality standards set for the new plant.

The owners specified that the minimum temperature to be maintained during working hours was 65° F. For operating cost calculations, it was assumed that this temperature would be maintained for 10 hours per day for five days, and eight hours for the sixth day—a total of 58 hours per week. Temperature was to be maintained at 45° F during the non-working hours, 110 hours per week. Total heat loss for the plant was calculated at 1,120,000 Btu/hr.

Although Brown & Matthews had previously used oil-fired boilers with steam unit heaters for practically all of their plant construction jobs, the advent of natural gas in the metropolitan area caused them to consider the feasibility of using gas-fired unit heaters for this project.

Consultation with the industrial and commercial heating specialists of Kings County Lighting Co., the local gas utility, disclosed that a complete heating system based upon the use of Janitrol gas-fired unit heaters for the factory area, and a Janitrol forced air conditioner for the office area, could be installed for approximately $7350.

This estimate was based upon the heating analysis and bill of materials shown in *Table 1* and the heating equipment was taken from the actual bill of materials for the job.

On the basis of standard costs and practices in the area, Brown & Matthews estimated the installed cost of an oil-fired steam boiler unit heater system at approximately $14,340. This figure would

TABLE 1. HEATING ANALYSIS AND BILL OF MATERIALS

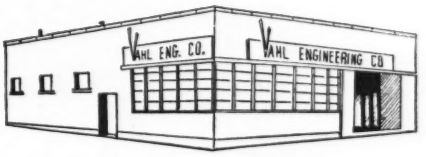
Location	Model	No. of Units	Btu Output/hr in thousands	Sq ft of Steam Radiation Equivalent
Manufacturing area	UBS-125-94	9	9 x 100 = 900	417 (each)
Men's lavatory and first aid	UBS-50-94	2	2 x 40 = 80	167 (each)
Men's lockers and corridor	UBS-50-94	1	1 x 40 = 40	167
Offices and lobby	FEC-120-84K	1	1 x 96 = 96	400
Totals		13	1116	4654

TABLE 2. OIL-STEAM UNIT HEATERS VS. GAS-FIRED UNIT HEATERS

Oil-Steam Unit Heaters	
Steam system installed, including boiler, stack and units	$13,440
Boiler room (not constructed when gas heating adopted)	900
Total installed cost	$14,340
Annual operating cost: (20,000 gals. of No. 5 fuel at $0.105/gal.)	$ 2,100
Gas-Fired Unit Heaters	
Gas-fired unit heaters installed, including all plumbing, electrical work, etc., to complete	$ 7,350
Annual operating cost: (1,125,000 cu ft 1030 Btu natural gas at $1.60/Mcf) *	$ 1,800

*Minimum rate in Kings County Lighting Co. schedule; takes effect after monthly use of 5300 cu ft of gas.

49% on heating costs



By taking advantage of the installation economies possible with gas-fired unit heaters, Vahl Engineering Co. of Brooklyn, N. Y., was able to save 49% of the estimated cost of a new plant's heating system. The company also found that the greater operating efficiency of gas-fired unit heaters compared to steam unit heaters permitted annual savings of $300 (17%), even though using the nominally higher-priced gas fuel.

include the cost of the boiler plus the unit heaters, as well as the construction of a "utility room," with stack, to house the steam generating equipment. Comparative installed costs for the steam and gas systems are summarized in *Table 2.*

Although oil sells at a considerably lower rate per therm in the metropolitan area, the greater efficiency of gas-fired unit heaters was estimated to permit an annual fuel cost saving of $300. According to the builders' original estimates, annual heating costs for the oil-fired boiler and steam unit were $2100 (based on the use of 20,000 gals. of No. 5 fuel oil at $0.105/gal.). The industrial and commercial heating department of the lighting company calculated the annual heating cost with gas-fired equipment to be $1800. On the basis of fuel costs for the 1951-52 season, this estimate has been substantiated. Exact determination of the space heating costs is impractical because the plant also draws gas for heat treat furnaces and a water heater from the same meter that services the space heating equipment.

The new plant follows modern ideas in its one-floor construction with a high percentage of wall space taken up by windows, as shown above. These sweeping areas of glass make maximum use of the natural light that is so desirable for precision machining operations.

However, these same expansive areas of single thickness window glass materially increase winter heat losses. The well known high thermal conductivity factor of glass (glass has a "U" factor of 1.13 compared to a "U" factor of 0.50 for 8 in. of brick) thus creates problems in providing comfortable winter temperatures throughout the plant.

Gas-fired unit heaters are extremely well adapted to plants of this particular construction. Since the heaters are suspended from the ceiling, they can be located to maximum heating advantage without taking up floor space that might be more useful for production machinery *(Fig. 1).* Moreover, the heat can be directed by means of louvers to the areas where it is required. Details of the suspension of the unit heater are shown in *Fig. 2.*

In plants where exhaust steam is available, steam unit heaters often are the economical means of space heating. However, the installation of a boiler at Vahl Engineering, where steam is not otherwise used, would mean inefficient operation of the boiler at a small percentage of its rated capacity during the off-peak heating season. If the plant should be expanded, the increased heating load would be more readily handled with additional gas-fired unit heaters than by replacing or increasing the existing boiler capacity.

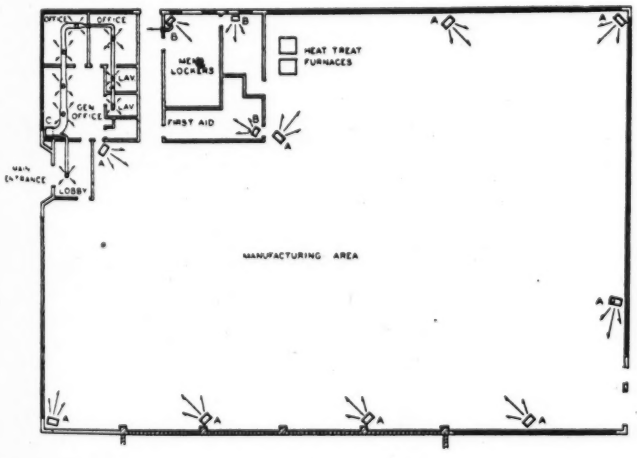


Fig. 1. General floor plan of the plant. The heating equipment includes three unit heaters and a forced air conditioner.

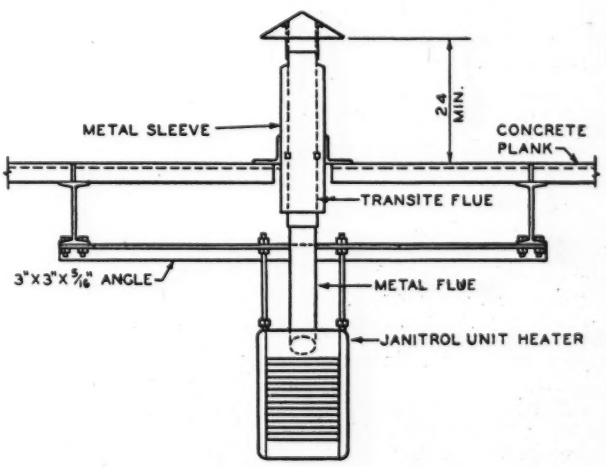


Fig. 2. Method of hanging unit heater and transite flue through roof.

Milwaukee Gas goes to extremes to prove dependability of gas

By **ROBERT HANNON** • Milwaukee (Wis.) Gas Light Co.

WHEN natural gas was introduced into Milwaukee, there were numbers of people who questioned the advisability of changing from manufactured to natural gas. We had told our customers that it would be a great advantage to them for us to bring natural gas into Milwaukee. It was therefore a challenge to assure our customers of an uninterrupted and properly controlled supply of natural gas. We were determined that not one of our customers would be able to say to us that natural gas service is not dependable.

With this background in mind, I will attempt to inform you of the methods and equipment that we utilize to prevent service interruptions to our customers, either winter or summer.

From the customer relations standpoint, service interruption is a serious problem. If the interruption extends overnight into the following day, the problem becomes acute, especially during winter months.

Most causes of service interruptions can be corrected the same day. Generally the correction is made on the first call to customers' premises. Examples of such interruptions are plugged services, service regulators out of order, gas shut-off in error, stuck meters, and gas left off because customer was not at home when repairs were completed. In these instances the customer is but slightly inconvenienced, provided she is given immediate service.

We are more concerned with those causes of service interruptions that, for many and various reasons, are not eliminated the same day. Leaking service pipes are probably the most frequent causes of service interruption in this category.

To improve our service, two things were done. First, a closer coordinated effort was worked out between the service and street departments. In the past, when leakage was isolated to service piping, the service department generally had no alternative but to shut off the gas at the service stop box. The customer then waited until the street department made repairs.

Under the new and present procedure, when customers service department locates leakage as coming from a service line, the main and service investigation department is radio dispatched immediately to investigate the leakage. In many instances, temporary repairs are made. In other cases the regular street department repair crews are notified to make repairs the same day. This close coordination and faster communications has reduced overnight service interruptions to a bare minimum.

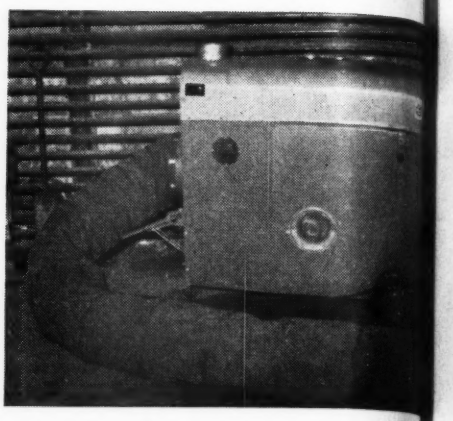
Secondly, all cases of service pipe leakage or stoppage cannot be repaired on the same day. Standby equipment is provided for and procedures have been worked out for rendering temporary service to the customer during extended interruptions. This procedure has proved to be most satisfactory, and during the last year and one-half, none of our customers, to our knowledge, was without facilities for cooking and heating overnight.

It would be amusing to you and possibly amazing to see how we improvise at times to be certain that our customers do not experience extended interruptions. If distribution is unable to eliminate service interruption, we of the customer service department step in and make provisions to see that our customers are not inconvenienced and are kept comfortable.

We are able to accomplish this by having emergency equipment on hand at all times. A description of this equipment and the manner of its use is described.

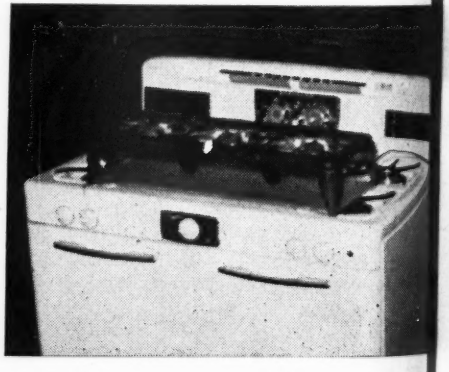
L. P. Gas Sets:

Description: Set consists of a 25-lb. L. P. gas tank, pressure regulator, 35-ft coil of



Portable space heater used by the Milwaukee Gas customer service department as part of its standby equipment for rendering temporary service to customers during extended interruptions.

L. P. gas sets installed by the company make it possible for the customer to cook when service is interrupted. The tank (above) is installed outside the house and connected by the tubing to the hot plate inside (below).



(Continued on page 48)

IT'S A CINCH TO DEMONSTRATE

the exclusive features of Detroit Jewel and GARLAND

GAS RANGE

the "futura" with

Full Width Oven

It's wowing 'em everywhere! An all-out functional range that meets the new trend in modern living. Open the oven door! Open the broiler door. *Easy to demonstrate. Oven measures 23" by 16¾" by 15". And the broiler is 23" wide.* A *compact* range that does the whole cooking job for a big family.

TWO NEW MODELS NOW READY!

TWO NEW HANDI-HI ELEVATED BROILER RANGES

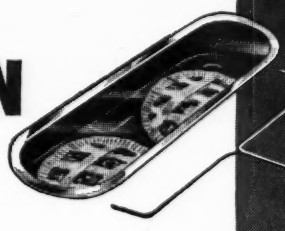
One in DeLuxe, one in Imperial series make these ranges even greater values!

exclusive

TOP-VUE OVEN

(Patent Pending)

Nothing like it before! Touch a button! Like magic, you see right through the cooking top into illuminated oven. No stooping—or squatting or squinting. An eye-popper. A sure-fire sales-maker. *Easy to demonstrate.*

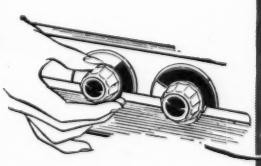


exclusive

SIGNA-DIAL

(Patent Pending)

Brand new idea in top burner controls! Shows at a glance which burner is turned on and to what extent. Simple—nothing to get out of order. Eliminates worry. Makes peeking unnecessary. Makes cooking easier. Easy to demonstrate.

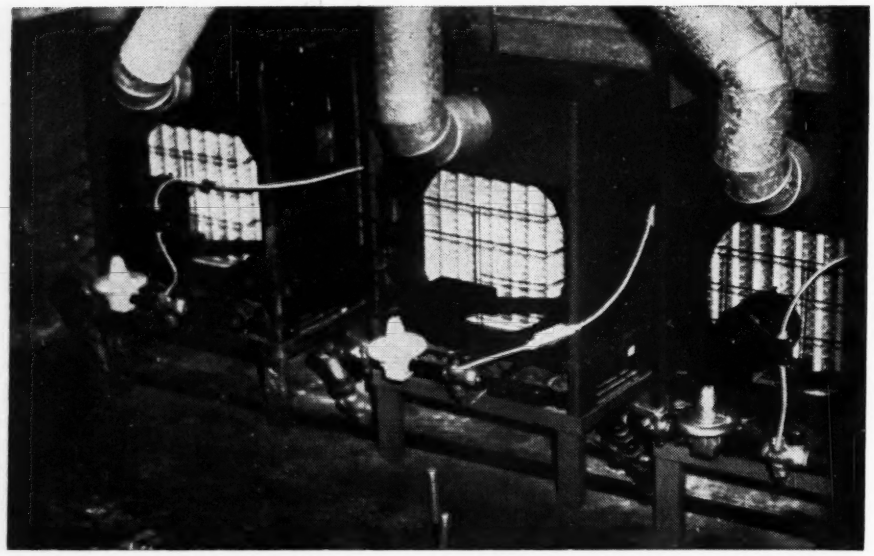


DETROIT-MICHIGAN STOVE CO.

DM PRODUCTS

Fine Ranges Since 1864 . . . Detroit 31, Michigan

® Detroit Jewel and Garland are Registered trade names of Detroit-Michigan Stove Co.



These three gas-fired unit heaters, each one mounted near the base of a lacquer drying tower, have helped speed up radio hook-up wire production at the Holyoke (Mass.) Wire and Cable Corp.

Use of gas increases production 50%

The replacement of electric ribbon resistors with gas-fired unit heaters made it possible for the Holyoke Wire & Cable Corp. to secure a 50% increase in the production of radio hook-up wire, which is currently in wide demand throughout the radio, television, radar and related industries.

This Holyoke, Mass. wire house faced a difficult production problem during the early months of 1950. Radio hook-up wire, from 10 to 26 gauge, was selling in constantly increasing volume. Plant layout and equipment could keep pace with demand up to the point where a flame resistant lacquer was applied over the glass or textile covering but the lacquer room could not keep pace with the braiders, and hook-up wire production could not keep pace with sales.

In May 1950, a gas-fired unit heater supplied by National Radiator Co. was installed in the lacquer drying tower. Production immediately picked up. In July of that year another unit heater started to dry lacquer in a duplicate drying tower. A third unit heater, in a third tower, was put to work a few months later, and the knotty production problem was solved.

The three-heater schedule for lacquer drying is a 24-hr production day, 5 days a week, with 1500 ft of wire passing each minute out of the drying tower and on to the take-up reels. The fuel cost is approximately $5 per unit heater per day.

A knowledge of some supplemental details behind this expedited production assists in gaining a clearer understanding of how the lacquer drying problem was solved.

Electric heaters in the drying towers provided an air temperature of only slightly above 100°F. At this temperature, lacquer would dry satisfactorily, if it did not pass too quickly up and down the 25-ft drying tower. When its travel was stepped up, the lacquer was wet upon arrival at the take-up reel.

A step up in speed was very desirable because any increase above five days' production of the braiding machines was putting pressure on the six-day operations of the lacquer room.

The Series C gas-fired unit heaters, having 215,000 Btu input per hour and 172,000 Btu hourly output, are installed near the base of the drying towers. Fans on the units have been removed. Their air movement was unnecessary since an exhaust fan was required to dispel lacquer fumes from the towers.

Fire insurance regulations required that 10,000 cu ft of fresh air pass through the towers for every gallon of solvent evaporated in the cable coating lacquer. This solvent representing 70% of the lacquer's content, produces fumes that are explosive in character.

An airstat, mounted in the hot air duct leading to the tower, controls the gas unit heater, which is providing a 130° to 150°F air temperature to surround the lacquer coated wire as it passes repeatedly up and down in the drying tower.

According to E. S. Bartlett, vice president of the Holyoke firm, the installation of National Radiator unit heaters broke a bottleneck that was becoming more serious each day, eliminated the necessity of installing a steam boiler in order to secure higher temperatures in the drying towers, and made it possible for the braiding room to work six days a week with the lacquering operations so expedited that they could be accomplished in five days per week.

Continued from page 46

¼-in. copper tubing with connections and one two-burner hot plate.

Application: Hot plate is installed near window in kitchen or other convenient location. Tank and regulator are installed near window on outside of building. Tank and two-burner hot plate are connected with tubing installed over window sill. After making connections, the installer purges, tests for leaks and explains operation to the customer. A foreman follows up and inspects for safe and correct installation.

Hose Connection Sets:

Description: Sets consist of random lengths of 1¼-in. heavy duty rubber hose with 1-in. pipe nipples in each end.

Application: Hose is installed through basement windows to connect meter installations with active service pipe in adjacent building. Sections of hose that cross driveways or walkways are barricaded and provided with lanterns. Openings between windows and frame caused by hose passing between must be ragged off tightly to prevent entry of cats, rats, birds, or other animals.

Portable Space Heater:

This portable heater was perfected and used by the U. S air forces in World War II. It is easily transported from job to job. Two solid rubber tires on one end and a stand bracket at the other end make for easy handling.

Description: Model GT 3072 Herman Nelson portable heater. Heater burns range oil or kerosene. It has an output of 250,000 Btu per hour. Heat is circulated by electric, motor-driven blower. Heater is provided with two 12-in. diameter collapsible ducts which extend to 12 ft in length. The fuel supply tank holds approximately 20 gals. and lasts for about five or six hours of continuous operation.

Application: Heater is used only when structure to be heated is beyond practical distance of temporary hose connection to active service or main. Heater is installed near windows outside of building. Electric cable and heat ducts are installed through window into building.

With the limited amount of equipment listed above, we have been able to eliminate extended supply interruptions both on single services and, in many instances, main interruptions. Under no circumstances do we at the Milwaukee Gas Light Co. tolerate extended supply interruptions. Because of this attitude and the action taken to insure against service interruptions, we have improved our customer service considerably.

We recommend for your consideration a similar program in order to prove beyond a doubt to our millions of customers that gas is the most dependable fuel in use today.

Adapted from a talk given before the Wisconsin Utilities Assn.

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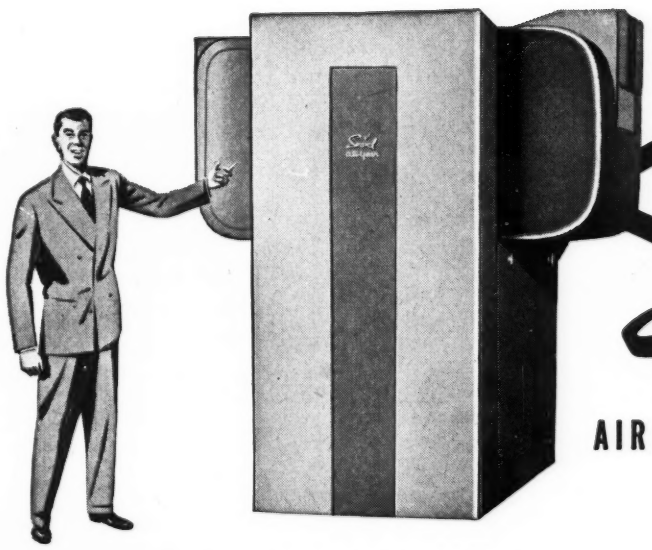
So recommend Servel *All-Year* Gas-Fired Air Conditioning. You can do so with confidence that every Servel unit will operate quietly and economically.



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Natural gas-propane plant shaves Washington's peaks

Combining storage project and propane-air production minimizes investment for Washington Gas

READIED for operation in time for the current winter's peak demands was the new Rockville combination storage plant of Washington (D. C.) Gas Light Co. Combining high pressure natural gas storage in buried bottles and propane-air production, the setup provides a total capacity of 100 MMcf of natural gas equivalent, giving a maximum sendout of 7 MMcf per hour or its thermal equal, 6 MMcf of propane-air-natural gas mixture.

The type of plant selected was determined by a number of factors—physical, economic, and expedient. Material shortages were a factor, as was the lower investment and operating cost of propane-air production as compared with a total investment in high-pressure natural gas storage. Used for peak shaving, the plant will hold down demand charges for pipeline gas. Rapidity with which the facilities could be pressed into service was also a factor: Should a break occur in the supplier's lines, straight natural gas from storage can be made available in minutes, allowing time to prepare for the production of propane-air.

The plant also has a high recovery rate, allowing the station to be used to supplement already existing facilities for hourly distribution peak shaving. Compressor capacity of 4800 hp moves natural gas into storage at the rate of 36 MMcf per day.

Plans for the plant were made in 1950, when, following the company's conversion to natural gas in 1946 and 1947, gas demands grew rapidly. Extensive laboratory tests were made to assure satisfactory appliance operation with the gas mixtures. Four parts of 1500-Btu propane-air-gas mixed with six parts of natural gas gave reasonably good results with a 50-50 thermal average and a Btu content of 1250. Lower propane-air mixtures would have been satisfactory but would have required a greater investment in air compressors.

The location of the plant, close to the Rockville (Md.) metering station of the supplier, Atlantic Seaboard Corp., but 10 miles northwest of the District of Columbia, dictates high-pressure operations. Here Washington Gas receives its gas into three of its four transmission lines—12-, 16-, and 22-in.—at pressures up to 250 psi. Two of these, the 12- and the 22-in., traverse the storage site, and the 22-in. can be used to deliver gas into or out of storage as well as transmitting gas to the distribution system.

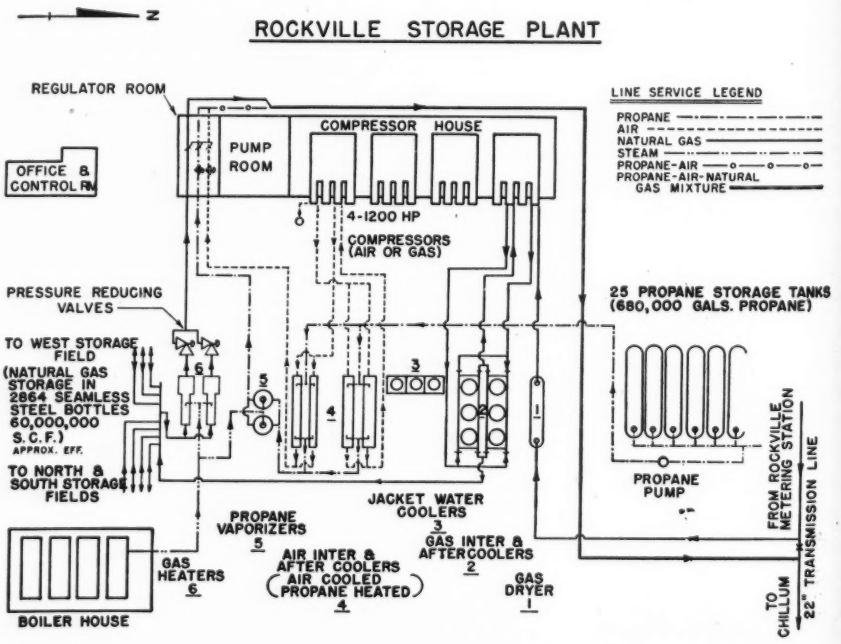
The higher pressures are an advantage on the inlet, as gas must be compressed for storage, but since an outlet pressure of 250 psi must be obtained, more horsepower than is usually required was necessary to compress air for propane-air production.

Dual purpose compressors, four 1200-hp gas engine driven compressors each having two gas compression and two air compression cylinders for two-stage operation on both gas and air, both boost the gas pressures and compress air for propane-air production. The engines operate over a speed range of 160 to 320 rpm and are equipped with automatic fuel shutoff and ignition grounding devices. In addition, since the air intercoolers and aftercoolers are used to preheat liquid propane, another shutdown device operates automatically should difficulty arise at the heat exchangers.

Before being compressed to its 2240-psi storage pressure, the incoming natural gas is dried in a fully automatic two-chamber unit, which operates on a three-hour cycle, using 9000 lbs of activated alumina desiccant to reduce the water content to less than 0.4 lbs per MMcf. About 1200-1600 cfm of gas heated to 300° F by a 250-kw electric heater is passed through one of the chambers to reactivate the desiccant.

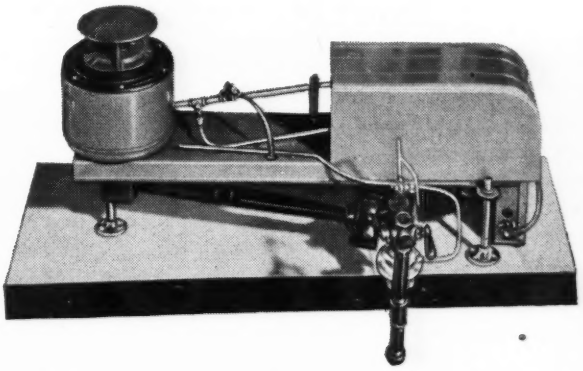
Interstage cooling and afterstage cooling of the gas are accomplished with two Fin Fan air cooling units.

Compressed natural gas flows through seven 6-in. field headers to the storage field where the 2864 storage units, laid under a minimum of 3½ ft of cover, are arranged in groups of 16 to 45, varying in accordance with the shape of the field. Within the groups, units are spaced



How The Gas Service Company developed a combination gas-oil burner to solve load problems

Peak-load periods in Kansas City left little gas for home heating. Yet, in off-peak periods plenty of gas was available. The Gas Service Company developed and introduced this special gas-oil burner to solve the problem. Now the home owner with a gas-oil burner uses gas 85% of the time—and switches over to oil during peak-load periods. Operation, including switch-over, is completely automatic—with Honeywell controls playing a major role in the public acceptance of this gas-oil burner.



Gas-oil burner proves popular with customers

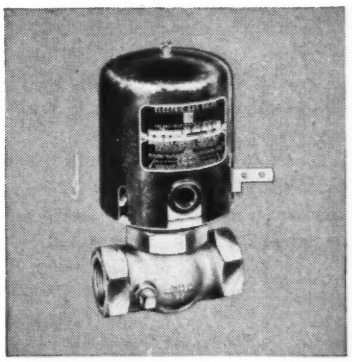
Home owners benefit greatly from this automatic gas-oil burner because they no longer are dependent on one fuel source. The company's steady promotional effort using lively displays, like the one to the left, demonstrations and newspaper advertising has resulted in steady sales increases since the burner was introduced by The Gas Service Company 5 years ago.

Over 80% of The Gas Service Company's automatic heating installations have Honeywell controls

The Gas Service Company has made steady progress in promoting gas home heating. Wise management policies combined with aggressive merchandising programs have helped show increases in gas sales year after year, until today The Gas Service Company has over 4,000 miles of street mains to deliver gas to its 400,000 heating installations.

For example in 1925, the company officials decided to sell and promote gas heat as the "automatic heat." Honeywell controls were used in many of these early installations and today *some of these controls are still in operation* —which is dramatic evidence of the rugged dependability Honeywell builds into each control.

Honeywell controls continue to give reliable, trouble-free service in the Kansas City area. Customer acceptance of Honeywell in Kansas City has grown over the years until today, 80% of the gas home heating installations are equipped with Honeywell controls.



Honeywell's famous motorized gas valve

The V-155 has long been considered the finest motorized gas valve available. This low-voltage valve is ideal for installation on furnaces, conversion burners or boilers. Because it's well designed and carefully assembled, this rugged V-155 assures long, trouble-free operation.

MINNEAPOLIS **Honeywell**

First in Controls

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8 ft apart end-to-end and 15 ft center-to-center. End-to-end connection is through 1-in. diameter expansion loops, and a similar loop is used to connect each group to a 2-in. manifold.

Recording thermometers installed at two localities measure the temperature of gas in storage. All of the storage units, piping, and headers (except for valves and pressure gauges which are available in the manifold) are installed below ground. All piping and storage units are wrapped and cathodically protected.

Gross storage capacity is approximately 67 MMcf, of which 57 MMcf is deliverable at design outlet pressures. Gas withdrawn from storage is preheated with steam to minimize freeze-up and hydrate formation, before pressures are reduced.

Liquid propane, received at a railroad siding and transported from tank car directly into a pipeline through which it is pumped into storage, is placed in 25 wrapped and cathodically protected tanks. The tanks, of 30,000-gal. water capacity and 25,000-gal. aboveground propane capacity, are buried, which gives them a total net storage capacity of about 680,000 gals., the equivalent of 59 MMcf of natural gas. They operate at 250 psi.

A special valve operated by a hydropneumatic system is installed at each tank outlet, closing automatically in the event of fire. They may also be tripped manually at four points. The usual excess flow check valve in the 4-in. liquid outlet line could not be used because the liquid must be withdrawn at high rates of flow with two 340-gpm centrifugal pumps.

Pressured natural gas is utilized to maintain a positive head at the suction of the propane tanks during operation. The propane liquid flows from the pumps through the compressor air intercoolers and aftercoolers for preheating, and then to the vaporizers which are heated by low pressure steam. Superheated propane vapors pass through a knockout drum which stops all liquid flow in the event of carryover from the vaporizers. The propane-air can be mixed with gas from storage or from the main 22-in. line. Appropriate controls hold pressures and ratios within the necessary limits.

All principal operations are indicated on a graphic control board, including compressor engine speeds and loading, propane tank operations, flowing quantities, pressures, temperatures, etc., enabling the operator to quickly visualize operating conditions in the plant.

Gas-fired auxiliary furnace helps maintain brick-drying schedule

Firing with gas at the Milliken Brick Co., Wilkinsburg, Pa., produces 340,000 bricks in two kilns every six days or every 144 hours. Six rectangular, downdraft kilns, which operate on a schedule of two light-off and cooling-down periods a week, normally supply the quantity of hot air needed to dry the green brick previous to firing.

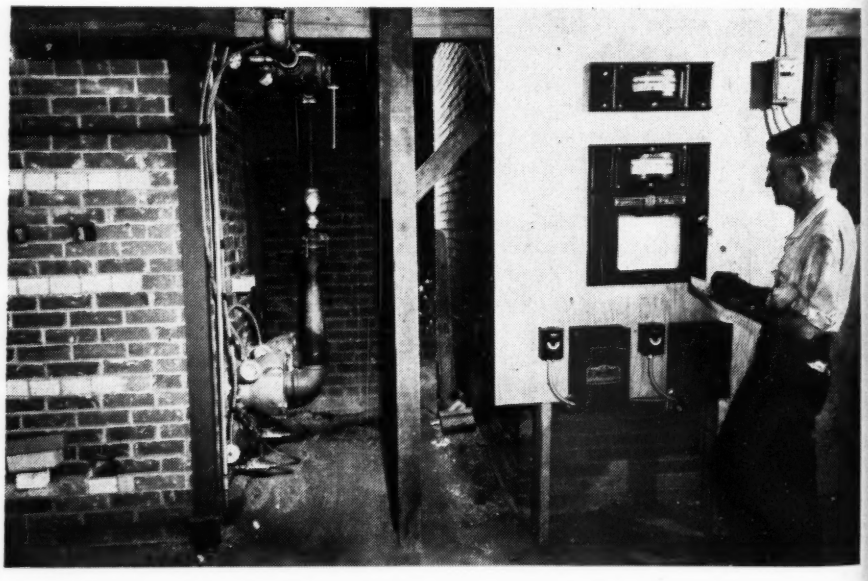
Since this tight operating schedule does not allow leeway for an extended kiln outage without interrupting the drying-air supply, Milliken Brick has installed an auxiliary gas-fired emergency furnace.

Feeding into the heating duct for the drying tunnels, the automatically controlled furnace can be put into service whenever drying-air temperature falls below the limit of 400° F. Fitted with twin 3-in. inspirators and burner nozzles, flame-failure devices and a safety shut-off valve, the furnace operates automatically through a pyrometer controller.

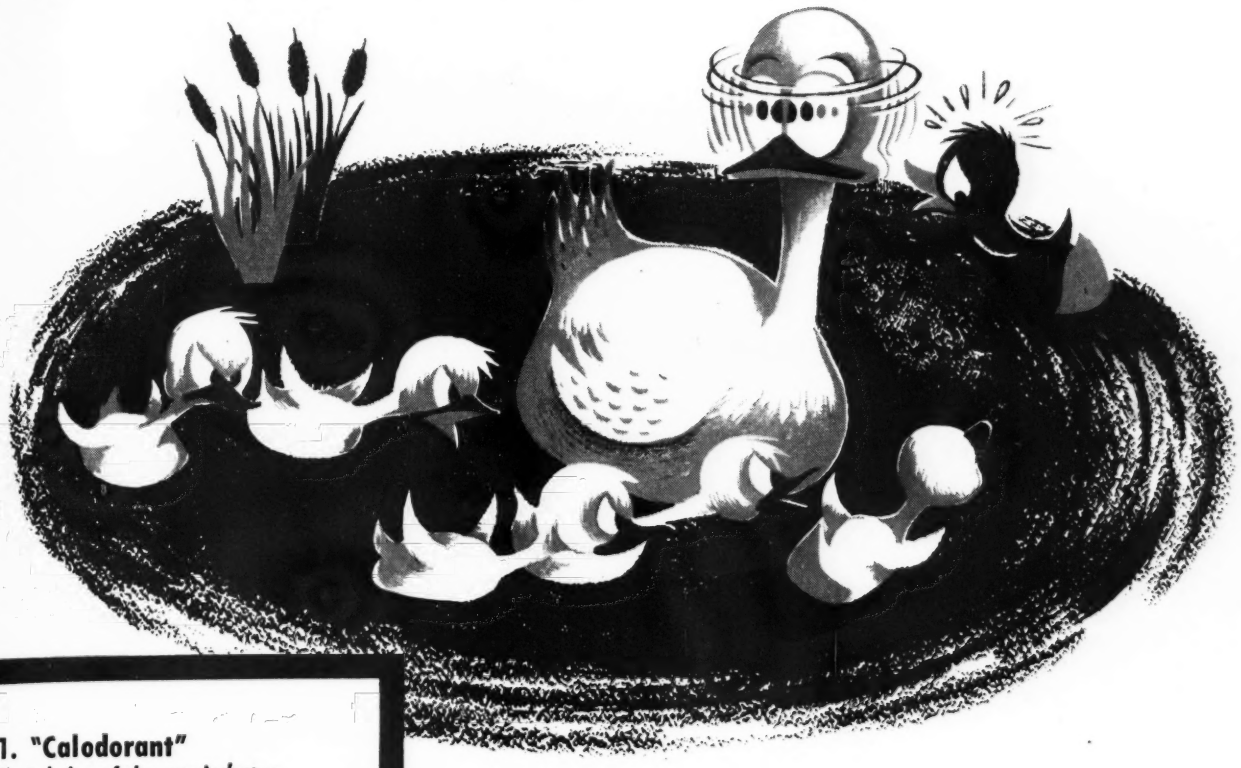
Using gas in kilns at Milliken has proven economical because it (1) gives closer control of color range, which makes it easier to match color shades on large batch orders; (2) increases production and provides a higher percentage (95%) of top-grade brick; (3) eliminates erratic temperature variations caused by manually firing solid fuel; (4) cuts firebox and bagwall refractory repairs more than half; (5) does away with the cost of tools and labor for coal and ash disposal and cleaning flyash from flues; and (6) meets smoke ordinance regulations and improves community relations with a nearby residential neighborhood.

Gas supplied by the Peoples Natural Gas Co. comes to the yard meter house at 40 psi where it is reduced to 18 psi for distribution to the kilns through a 4-in. header. Branch manifolds feed 14 high-pressure, manually controlled, inspirating burners on each side of the kilns. Burners, complete with pressure gauges, are detachable so three complete sets can be transferred as needed to handle the six kilns. Kiln heat is controlled in incremental steps in increasing the burner pressures at a predetermined rate during the firing cycle, which results in a gradual and uniform temperature rise over the firing period, up to final burning-off temperature of 2100° F.

Previous burning time with coal required from 180 to 196 hours, but since installation, one year's operation equalled 161 burns of 144 hours each. This is equivalent to two extra kilns of brick a month, an impossible capacity increase on coal firing without making a capital investment for two new kilns. Added to this is the fact that tests made on two remodeled kilns indicate that burning time can be cut to 134 hours, a reduction of 46 hours from the time needed for coal.



The emergency furnace for supplying drying air ties directly into the heating duct. Once lighted, it functions automatically to hold drying air temperature up until another kiln is taken off for cooling.



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2. Calodorant "C"

Gas engineers wrote the specifications for this cyclic sulfide type gas odorant which has a truly distinctive odor. Widely used at the rate of ½ pound per MMCF of gas.

3. Calodorant "C" Special

Has essentially the same characteristics as Calodorant "C", but is compounded to give effective odorization at 1 pound per MMCF of gas.

4. Alert

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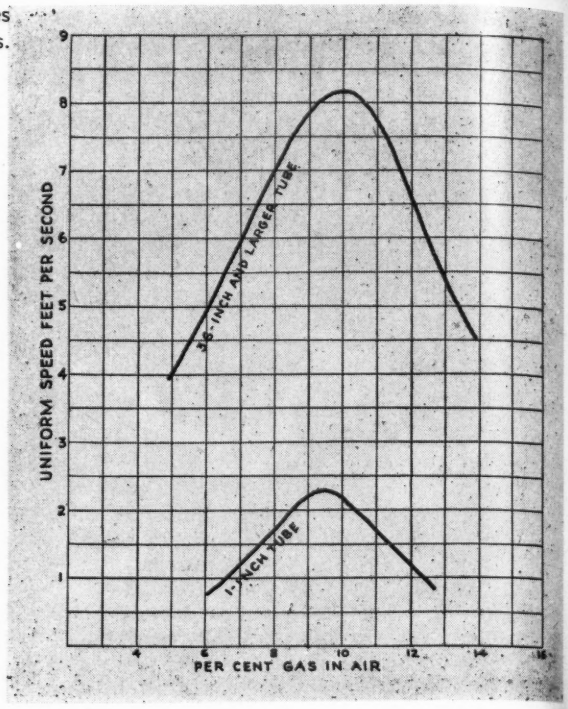
2617

Flame speed of typical natural gas at 60° F varies with temperature in order at V= .91 X T² Abs. Fig. 1.



Efficient use of boilers and direct-fired heaters

BY O. S. HUBBARD • Wickes Boiler Co., Tulsa

The casual attitude that exists among natural gasoline plant operators toward the utilization of stripped natural gas in their own plants for boiler and direct-fired heater fuel is anachronistic, according to Mr. Hubbard. Today, natural gas is too valuable to be wasted in any equipment that does not utilize it with high efficiency.

His intentions in this article are to acquaint plant operators with the design components of such equipment. The approach is unusual in that the components are considered as separate entities, and the handling is deeply analytical.

RARELY does the operator of a natural gasoline plant have the opportunity to participate in either the design or the selection of the equipment that is installed in the plant that he must operate. These factors are usually established irrevocably by others when the plant is designed or constructed.

It is my purpose, in this article, to analyze the design components of fuel burning equipment used in these plants as they are established by the plant designer and as they affect the operator of the equipment. The components involved are the following:

1. Burners to meter fuel and air to the furnace and to carburet the mixture.

2. An ignition zone to start the mixture burning.

3. A furnace, the only purpose of which is to finish burning the fuel; in other words, providing a reaction chamber for a phase that is strictly chemical.

4. A heat exchanger to convert the heat generated into a medium appropriate and suitable to attaining the final required result.

5. A scavenging system that will establish pressure differentials resulting in smooth flow of combustion gases and discharge of those gases from the system so that an obnoxious condition will not be created.

Any design or correction of existing design must start with capacity required. The quantity of heat is established by process or power requirements of the particular project and from this it is easy to establish total quantities of fuel and combustion air for an individual heat producing unit.

Now comes the most important step of all: releasing the heat. It is unfortunate that boiler people, and manufacturers of gas-fired units for heating oil to a lesser degree, have throughout the years designed heat exchangers along empirical lines and often just to suit personal convenience, with only incidental thought given to where the heat to be exchanged would come from. This was the consistent policy in the bare boiler days, which do not seem to be entirely past. Purchasers of such bare boilers or gas-fired oil heaters usually had quite a scramble in trying to provide that heat. Out of this grew a rather large list of burner companies. Business was good, too, because most of the burner manufacturers got a whack at trying to make each installation produce the quantity of heat at efficiencies the user believed inherent in his exchanger.

We have deliberately placed the three factors relating to the production of heat ahead of the heat exchanger. The fact is that if the heat is not produced, it cannot be exchanged. Obviously, however, the five components that have to do with successful performance are closely related. And it is equally obvious that these components cannot be individually disposed of unless their relationships to other components are carefully considered. Many of the related factors are not reducible to presently established or practical mathematics and depend largely on the ingenuity and experience of the designer.

The first three factors are commonly wrapped up in a rather loosely used term and described as gas burners. Actually, such terminology is pre-empting the duty of the furnace. A burner is a mechanical contrivance while a furnace is a chemical retort.

There are three functions the so-called burner is called on to perform. They are:

1. Metering or proportioning fuel and air to the furnace.

2. Mixing of the two to ignitable proportions.

3. Igniting the mixture.

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Most failures in performance come in one or all of these three steps.

Gas burners, to use common nomenclature, fall in two general classes—those in which a part or all of the air for combustion is mixed with the gas before the mixture is passed through the burner nozzle (premix burners) and burns with characteristic blue fire, and those in which air and gas are admitted in separate streams, and have no nozzle or burner tip and produce at low velocities a yellow fire and at higher velocities, a fire that fades into blue or incandescence.

The flame from both burners, under ideal conditions of ignition and furnace reaction, is incandescent. Either depends on the same basic principle of operation in that at all rates of operation, they must mix the two gases in ignitable proportions and deliver the mixture to an ignition zone at correct speeds before the combustion reaction can take place in the furnace. In this respect, the burner is the counterpart of the carburetor of an internal combustion engine with the added requirement that a zone of ignition must be provided. The burner, therefore, operates like an engine. With mixtures slightly lean or slightly rich, flame speed is reduced and the engine misses or lopes and the furnace sputters and smokes. And, even with correct mixture, both stop if the ignition fails.

It will be seen that a knowledge of ignition speed is somewhat essential and the Bureau of Mines and others have determined these speeds for the basic gases. Natural gas, being a mixture of various gases, will have speeds varying with the constituents of the particular sample. Fortunately, this variation is small for a particular area. *Fig. 1* indicates the speed of a representative gas. While data are fairly complete for speeds in 1-in. tubes, it is only occasionally available for larger tubes, which have a proportionally lower heat loss to the surrounding atmosphere. It has been determined that the increased speed in larger tubes over speed in the 1-in. tube is in the same ratio for all gases, thus making the speeds determined in the 1-in. tubes of practical use for the engineer.

It will also be noted that flame speed increases with the temperature of the mixture being on the order of the square of the absolute temperature, corrected by a combining factor. This factor is not as yet accurately determined. It seems, however, to be on the order of 90%. At least such a factor gives predictable results. From *Fig. 1*, we see that mixtures containing less than 4.8% gas in the mixture and more than 14% are out of the ignition range and are not ignitable. These mixtures will also not support their own combustion unless external heat be supplied. It will also be noted that this particular gas, which is mostly methane, attains its maximum flame speed of 2.2 ft per second in a 1-in. tube at 60° F with 9.7% gas in the mixture. This is equivalent to 104% of theoretical air required for perfect combustion. A flame speed of 8.15 ft per second is attained in a 36-in. furnace not affected by external heat loss with 9.96% gas, equal to excess air of 7%.

The premix burner step by step meters fuel and air, mixes the two and then passes the mixture to a nozzle where ignition takes place. This sequence, readily analyzed and described, is typical of basic limitations for both types of burners, or for any fuel feeding device for that matter, and so renders the premix an ideal illustrative burner.

Referring to *Fig. 2*, the gas jet, with the aid of furnace draft, induces some of the air. Now we know that when parallel streams of gas flow without impedence for a distance equal to eight to ten times the diameter of the stream, complete mixing by diffusion results. This partial mixture is delivered to the nozzles of ports through which it issues to the furnace. The entrained air is known as primary air and its proportion depends on several factors, the chief of which are ignition and length of flame.

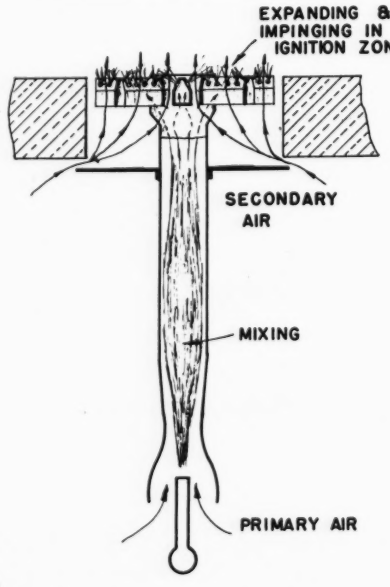

Fig. 2. The premix burner meters fuel and air, mixes the two, and then passes the mixture to a nozzle where ignition takes place.

With 50 to 60% of the theoretical air injected as primary air, the flame will be the true bunsen flame, with inner cone and outer envelope. At mixture velocities of some 6 ft per second, the flame length will be approximately 20 times the diameter of the nozzle, assuming that ample secondary air is supplied in such manner as to be available to the burning partial mixture. As the primary air is reduced, the flame becomes longer and more and more yellow appears. As the primary air is increased, the volume of mixture is increased and so is the velocity through the burner ports.

And here we encounter what seems to be a paradox. At 100% primary air, velocities through the port have only doubled, while the rate of flame propagation has almost quadrupled, yet ignition cannot be maintained. Also if we refer to the flame speed curve, we find we are using velocities in excess of those shown as limiting. Yet these excessive velocities are accompanied by stable ignition at partial mixtures, while with full mixtures at speeds in closer conformance to the indicated limits, ignition fails.

We have just seen that with speeds up to 6 ft per second and other conditions satisfied, the bunsen cone will be evident. This speed is about 30% greater than the large furnace flame speed. However, we can and do go up to mixture velocities of 20 ft per second under these same conditions with the type burner shown in *Fig. 2* with the cone disappearing as velocity increases and not noticeably present at speeds of 8 ft per second.

It would seem that higher temperature is increasing the rate of propagation. This is so, but not in the manner usually accepted. A moment's consideration will indicate that since the mixture contains no solids, it cannot receive radiated heat from one furnace at the instant it emerges from the port, nor for that matter at any other time.

While the partial mixture issues from the port at an excessive speed, it immediately expands and slows down considerably. The surface also comes in contact with the furnace atmosphere, creating friction, and picking up additional oxygen in a thin film of mixture surrounding the central core. This pickup satisfies mixture requirements and if the film speed is not excessive, ignition will take place just slightly after the mixture emerges. This film soon heats the principal stream by conduction and convection and, of course, the exothermic reaction, resulting in a continuing and accelerated sequence of sloughing off the

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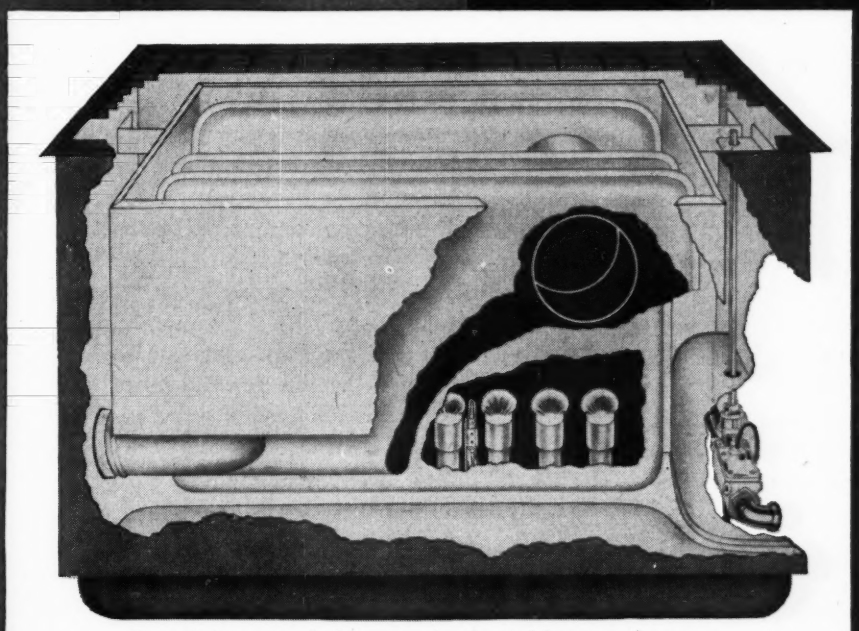

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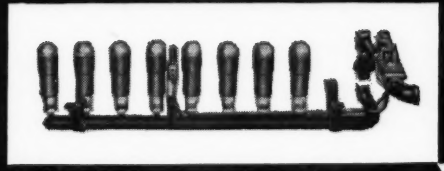

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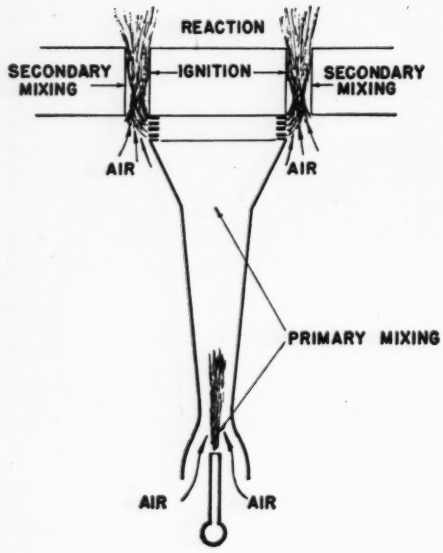

Fig. 3. Another adaptation of the same general principle. The only variation is in the ignition.

surface of the main stream. This also explains why the partial mixture ignites and why the full mixture fails to ignite. In the latter case, diffusion of the outer surface only results in over-aeration of the mixture film resulting in a mixture either having a slow speed or entirely outside the ignition range.

It will be noted that the arrangement shown uses the cumulative effect of several jets. By impingement and expansion, a flame is created that has sufficient body to prevent undue reduction in the mixture temperature by heat loss from the flame itself.

Fig. 3 shows another adaptation of the same general principle, the only variation having to do with the ignition. Here the mixture discharges at right angles to the final direction of travel where it meets a stream from an adjacent nozzle, at the same time mixing with and being deflected upward by a flow of secondary air. Here also has been added an ignition zone that both confines the mixture in close relation to the secondary air and provides a surface on which the outer skin of the stream may drag. Here we have a slow-moving stream to carry thin fire, heating the remaining mixture up to ignition and burning point. With this arrangement, we may increase the loading-up to an average velocity through the nozzle of 30 ft per second. The nozzle in this case is the free area, corrected for entrance loss, at the surface of the burner.

A third variation is illustrated in *Fig. 4*. The basic unit consists of a true venturi tube, which discharges through what is known as a sticktite nozzle, with the mixture being admitted to the furnace through a burner block or tuyere. Again the only variation of note is in the ignition zone. Here we see an annular ring provided around the main stream and baffled from that stream. Into this ring, a portion of the mixture is led through small weep holes, providing a slow-moving ring of mixture that entirely surrounds the main stream. We are therefore creating a ring of fire to surround the main stream of the partial mixture, which moves too rapidly to retain flame at the point of emergence. When firing into the open air, without the shielding effect of adjacent fires, or without the aid of the burner block, this nozzle permits mixture speeds up to 150 ft per second with an 80% primary air mixture, and with other mixtures, about 21 times the large tube flame speed.

And when the burner block or tuyere is added, possible velocities are infinite, so far as have been determined, provided, of course, that the percentages of mixtures are maintained within acceptable limits.

The most commonly used burner for larger applications is the secondary air type, which, as we have seen, produces a characteristic yellow fire. While the same basic factors of mixture and ignition apply, as in the premix, the steps are not so readily analyzed. Here we have no mixing tube, nor do we have a well defined ignition zone. We do have a condition very similar to the torch that in the past vented so much fuel as the only means of getting rid of it. We have in other cases a central jet of gas flow from the torch, usually at a pressure that results in a flowing projectile. If the torch is to remain lighted, some means must be provided to peel off the outside and mix the smaller portion with air, at the same time reducing the velocity so that the unlighted stream is traveling at an equal or lesser speed than the rate of flame propagation. On a smaller scale, that is just what we must accomplish in a secondary air burner.

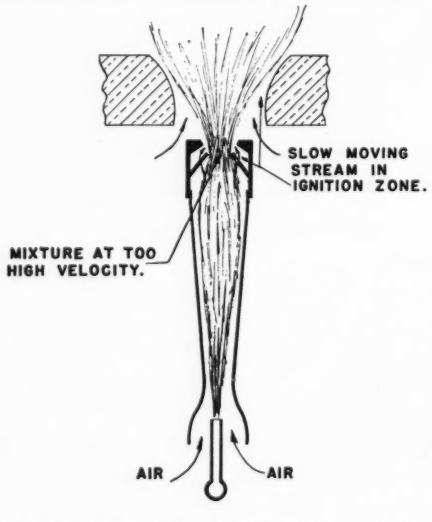

Fig. 4. A third adaptation of the premix principle. Again, the only variation of note is in the ignition zone.

The secondary burners are usually round with the air flowing through the register in the direction of its axis and the gas coming in at an angle from either a central point or from a ring arranged around the periphery of the register opening. Some turbulence is obtained by restricting the flow with a disc called a flame shield, which is just what it is.

With natural draft operation, the flow through the register may be likened to a wagon being pulled, in that the gases will follow the path of least resistance to the nearest point of pressure difference causing the flow. Consequently, any mixing will be by diffusion and friction resulting from varying initial direction and velocity of flow. Here we have no well defined place where the mixture may be heated. The only resource is to maintain the speed of incoming air and gas at those rates permitting combination and ignition. Some help is received from the flame shield, which does provide an area in the center protected from the higher speeds through the open area for a partial mixture fire to burn, this in turn heating the main body. In general, a secondary burner operating entirely on draft induced by the scavenging system may be summed up as having a top capacity equal to a flow of 40 to 45 ft per second through the net burner throat.

If this same secondary air burner is supplied with air from a source independent of the scavenging system, we find the same set of rules apply insofar as ignition is concerned. Here, however, we do have another source of power to be utilized in mixing or preparing the mixture. This added power is higher air velocity made available through the higher pressure differential between furnace and initial air supply. The air is now pushed instead of pulled and the direction of flow can be controlled and utilized to create greater turbulence and better mixing. The exact methods are many and varied, depending on the thinking of the manufacturer. The results will generally be equal to previously stated

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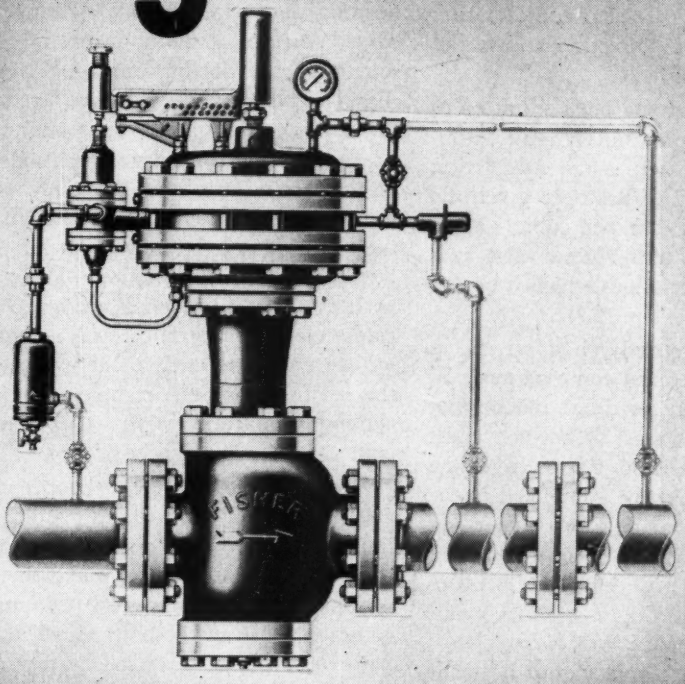

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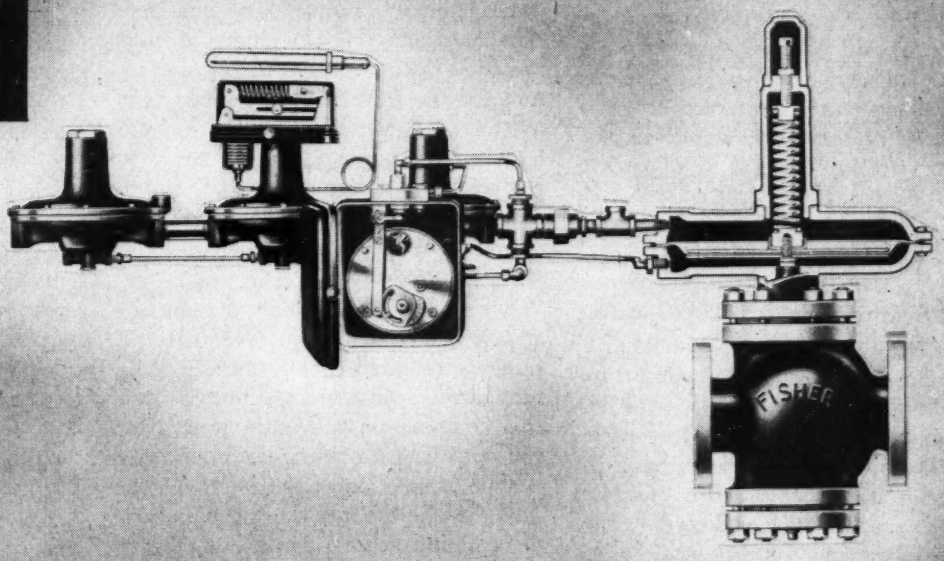

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LEADING THE INDUSTRY IN RESEARCH FOR BETTER GAS PRESSURE CONTROL

standards for mixing and ignition, and may be obtained with average flows up to 100 ft per second. Above this velocity the ignition becomes critical. The flow rate may be exceeded in certain instances, these instances being confined largely to preheating the combustion air and to registers in which special consideration has been given to direction and initial velocities of air flow.

The mixture having been admitted to the furnace and preliminary ignition obtained, the next step is the completion of the reaction. This has been given the name of heat release per cubic foot, a very misleading term, often used as a comparison of factors to which it has no relation.

This phase is strictly chemical and as is true of all chemical combinations, involves an element of time. Before that time element can start to become effective, the mixture, if not completed in the burner throat, must be completed in the furnace. It is not sufficient that air and gas be in the furnace. Each two atoms of hydrogen must be brought into contact with an atom of oxygen and each atom of carbon must find two atoms of oxygen. And the contact must be made at temperature at or above the ignition point.

Not too much is known and of record concerning combining time. Professors Robert T. Haslam and Robert P. Russell of Massachusetts Institute of Technology have determined that with city coal gas mixed with 108% of the theoretical air, the reaction was complete in 1/70 of a second. It is reasonable to suppose that other gases will have reaction speeds in the ratio of their flame speeds. The city gas in question has a flame speed in a 1-in. tube of some 68 in. per second. Average natural gas has a maximum flame speed under the same condition of some 24 in. per second. It would seem that at least 1/25 second should elapse between completion and ignition of mixture and impingement on a cold surface or exit from the furnace.

The mixture from a secondary type burner issues from the throat in a volume and at a speed that may be measured. It immediately expands by diffusion and from temperature rise, and slows down to a rate of flow as determined by furnace draft and thermal head in the furnace and cross-sectional area of furnace. In this connection, it is well to keep in mind that incoming air not incorporated in the mixture and any portions of mixture entering at fuel-to-air proportions outside the ignition range are at a gravity much higher than the furnace atmosphere and tend to sink to the floor. By the same token, these portions that have completed the combination are at full furnace temperature and, therefore, of much lower gravity and tend to float to the top. Portions still in the burning stage are in turn floating on colder portions at the bottom. As a result, owing to the burning of gas fuel, there are always three separate layers in the furnace atmosphere. It is not practical to attempt to analyze conditions in the furnace on this basis, especially since the mechanical energy of the incoming fuel and air supply introduces another factor affecting the reaction. These diverse and varied influences are much too complicated for practical use. Actually we are only interested in knowing that the reaction has been completed by the time the mixture reaches the furnace exit.

We have seen that having proper mixture and having effected and maintained ignition, we are now only interested in the time necessary to complete the reaction. It is relatively easy by purely common sense methods to visualize the path that will be traversed by the mixture in its travel from incidence to exit. And only that path is effective furnace volume.

In discussing mixtures, we saw that while portions of the mixture were of necessity in acceptable combining ratios, the principal quantities had not yet reached the required proportions. It then follows that the remaining parts must combine in the furnace, and our time element cannot become effective until this combination is reached. This uses up some of the travel length; exactly how much is a matter of conjecture at best. So we introduce a factor of safety to compensate for something we cannot determine and assume that the mixture should be in the furnace at least 15 times its combining time.

It then follows that flow differentials and areas should be provided that will result in required combustion air being brought into the furnace, at rates permitting combination and ignition and that sufficient length of flow be provided to permit completion of the reaction. The flow through the furnace exit will be the determining factor since it is useless to bring in mixture in volumes that will exceed the time element required for reaction. This is best determined from the basic hydraulic formula of:

$$\frac{\text{velocity, feet per second}^2}{(2\ g)\ (\text{volume per pound})} = \text{lbs/sq ft}$$

Right here a great many boiler and oil heater jobs fail, in that limiting factors concerning mixing, ignition, and reaction have not been balanced out.

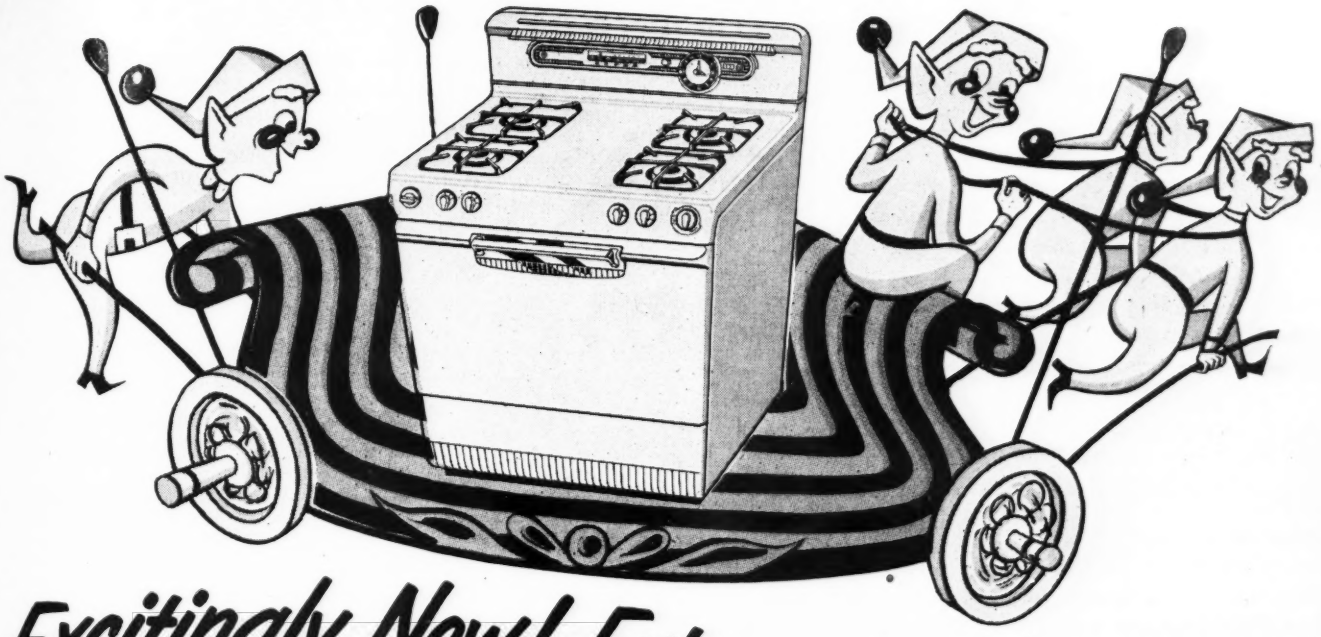
We can also see that the term volume may or may not be a determining factor as a measure of combustion efficiency. If burners are so arranged, with respect to the physical dimensions of the furnace, that the open area is fully utilized, then volume would be a measure of the time element. However, should the burners be arranged in such manner that a direct flow to the exit by-passes a portion of the furnace, then that part not utilized is not only a waste of material, but a direct reducer of efficiency by adding heat loss area and is not effective combustion volume.

We often hear heat releases per cubic foot recited as a measure of tube life. Nothing could have less relation, nor less bearing.

As an illustrative example, which is perhaps the quickest method of making the point, let us consider two three-drum water tube boilers, each containing some 3000 sq ft of heating surface and each designed to produce 25,000 lbs of steam per hour. Let us assume for the present that both will operate at 75% efficiency. That will not be true, but if we so assume, we will be on a comparable basis for furnace comparison. We will also assume that there must be added to each pound of water 1000 Btu in order to convert it into steam. Under this condition, we must release 33,380,000 Btu/hr. Let us assume this boiler to be set over a refractory furnace having 1250 cu ft of volume, and to have portions of the first two rows of tubes so arranged as to see the fire. A typical boiler would then have about 560 sq ft or 18.6% of the total surface in the furnace of which about 105 projected sq ft would see the fire. The projected area is, of course, only equal to the tube diameter times its length. Where circular tubes form part of the furnace wall more cooling surface is presented than simply its cross-sectional area. The effectiveness of the surface varies with tube spacing. For quick checks, it may be assumed as 1.4 times the projected area, resulting in 147 sq ft for the case in question.

Fig. 5 is presented as an approximation of a tedious operation, often subject to error. This and *Fig. 6* are offered for use as a slide rule is used; that is, as a check on more complete calculations. Like the slide rule, the use of these charts often reveals major errors.

From the preceding, we find a furnace



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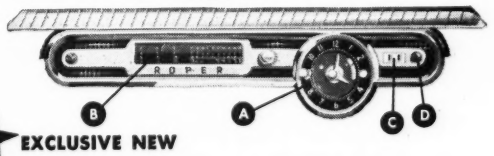

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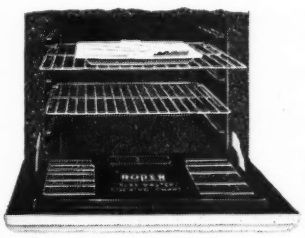

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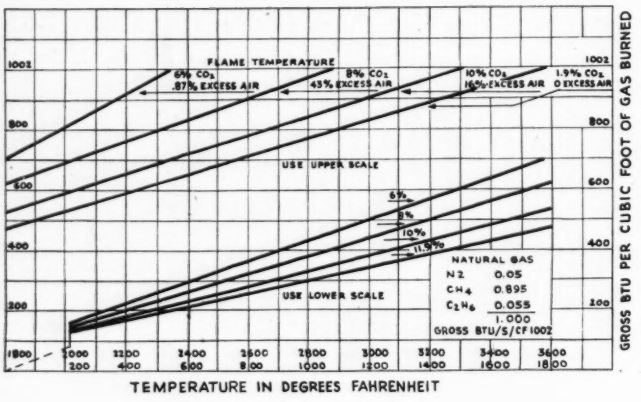

Fig. 5. Heat in combustion products based on air and gas at 60° F and 40% humidity.

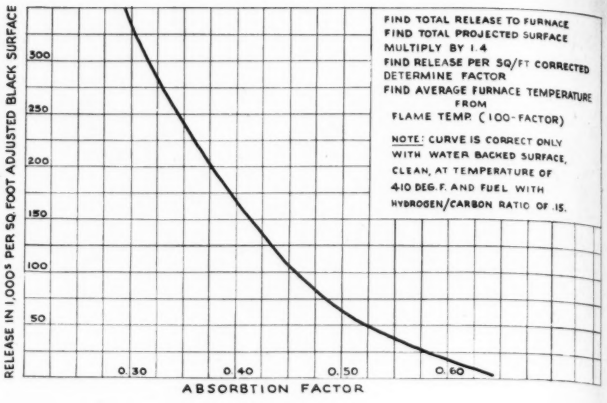
FIND TOTAL RELEASE TO FURNACE
FIND TOTAL PROJECTED SURFACE
MULTIPLY BY 1.4
FIND RELEASE PER SQ/FT CORRECTED
DETERMINE FACTOR
FIND AVERAGE FURNACE TEMPERATURE FROM
FLAME TEMP. (100-FACTOR)
NOTE: CURVE IS CORRECT ONLY WITH WATER BACKED SURFACE, CLEAN, AT TEMPERATURE OF 410 DEG. F. AND FUEL WITH HYDROGEN/CARBON RATIO OF 15.
RELEASE IN 1,000S PER SQ. FOOT ADJUSTED BLACK SURFACE
ABSORBTION FACTOR

Fig. 6. Furnace absorption rate check sheet.

release of 26,700 Btu/cu ft and also we have a release of 227,000 Btu/sq ft of effective radiation absorption surface and from *Fig. 6,* we find a factor of .35.

From the accompanying *Fig. 5,* we find that if we have used 16% excess air, at a products temperature of 3300°, there is a heat content in the products of combustion equal to the total higher heating value of the fuel so this must be ultimate flame temperature. On *Fig. 5,* a unity factor would indicate no heat loss and the remainder after subtracting the absorption factor would be both the average furnace temperatures and the temperature of the gases passing to the convection section. Here we find an average furnace temperature of 2180°, and from *Fig. 5,* that 11,500,000 have been absorbed by radiation for a rate per square foot of radiant surface of 79,000 Btu/hr.

Now let us look at another three-drum boiler of new design with water walls, but with only 700 cu ft of furnace volume. This boiler will have 1000 sq ft of heating surface in the furnace of which 165 sq ft are projected and the adjusted figure is 231 sq ft of effective surface. And now we find heat release per cubic foot of almost 48,000 while the radiation absorption rate is only 140,000 with an average furnace temperature of 1915° and with a radiant absorption rate down from 79,000 to 58,000 Btu/sq ft/hr. Obviously, combustion volume cannot in all cases be a measure of either furnace efficiency or of tube life, in either a boiler or an oil heater.

The fifth factor in boiler operation and efficiency is scavenging and that is the function of the stack or induced draft fan or forced draft fan. The method chosen for discharging the spent products of combustion depends on various outside factors such as nearness, shape, and character of adjacent installations, initial cost of the installation, and on the nature of the products, and is not necessarily decided by pure engineering considerations.

The draft equipment is also called upon to supply the differentials required to operate the fuel burning equipment and to overcome the friction that results in the system for establishing the required flows. Beyond that it has no function. Gas flow, however, seems to be less understood than any other branch of engineering and often the results of computing volumes, velocities, and gravities are truly amazing to behold. It is respectfully suggested that the basic hydraulic formula previously referred to be used at each stage of design, as a check of involved calculations.

Now, how can we apply some of these things, after an installation is made? To paraphrase a popular motto of the not-too-distant past, that is easily said, not so easy to do, and if difficult, get an expert.

Any given installation, whether its design is good or poor, will produce the best possible results only if we observe the above mentioned fundamental facts. If fuel and air are admitted in improper proportions, capacity and efficiency must suffer.

It is possible to make corrections within the limitations of the equipment by various means. Fuel and air flow may be varied and the results observed visually in the furnace. This must be done cautiously and carefully to avoid puffs and explosions. This method is not reliable. A safer and better way is to analyze cooled samples of flue gas drawn from the furnace exit by means of an orsat. The sample will show if proper burning is obtained and whether there is an excess or a deficiency of air in the mixture. The necessary fuel-air adjustments can then be made by the operator without any guesswork. The results of making such checks may be quite surprising. One may find that too much fuel is fed into the furnace and that reduction in the fuel flow without making an adjustment in the air flow may produce higher instead of lower capacity and, of course, greater efficiency. On the other hand, it may be advisable to increase the draft, i.e., the air flow up to the point where the flame begins to leave the ignition zone. This, however, affects the reaction zone resulting in increased speed in the furnace so that even with stable ignition, the reaction may not have time to be completed.

The operator may find that capacity is still lacking after furnace conditions have been corrected so that ignition is good and reaction in the furnace complete. In that case, it will, of course, be necessary to increase both fuel flow and draft, i.e., air flow until either ignition limit or reaction capacity has been reached. This condition would then constitute the practical limitations of the installation and for further increase in capacity, changes in the equipment must be made if this is possible. In a given furnace, it may be feasible to install more burners. Generally speaking, the more burners are used, the better the distribution, the better the mixing and the more effective the utilization of the available furnace.

Summing up:

By calculation, air and fuel velocities and volumes may be determined at each mixing orifice or burner.

Furnace reactions should be checked by accurate draft reading at the furnace outlet, from which rate at flow and furnace time may be estimated.

Having such data will usually indicate just the points requiring correction to improve an orsat analysis, increasing efficiency or capacity or both.

This article has been adapted from a talk delivered before a meeting of the NGAA.

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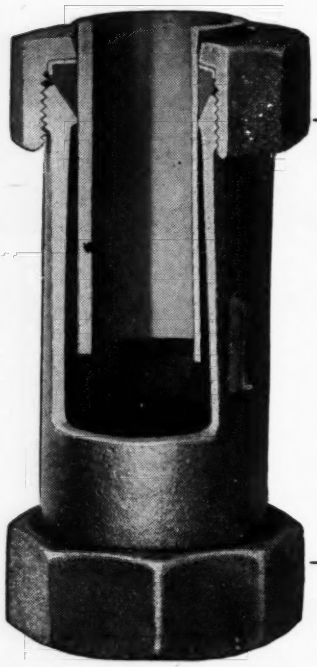

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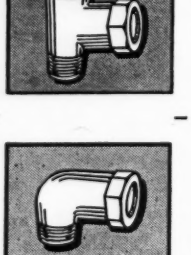

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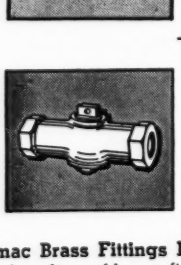

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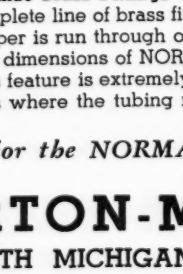

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Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

Write for the NORMAC CATALOG of Gas Distribution Equipment

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Couplings • Meter Bars • Sleeves • Cocks • Bell Joint Clamps • Service Tees & Ells

Thermally Thinking

(Continued from page 26)

will continue at a rate approaching, if not exceeding, the current rate, and (2) peak load demands will accelerate so long as the present price situation lasts; but the distinguishing mark of PAD's recently completed study on "Gas Requirements and Supplies of the Gas Utility Transmission and Distribution Industry, 1950-1955" is the authoritativeness of the overwhelming mass of statistical data included in it. If this be educated guess work, it's certainly the last word.

The PAD study devotes 68 pages of text, tables, and charts and about that many pages again in a statistical appendix to prove that, among other things:

1. Total sales of the gas utility industry of 42,090 million therms in 1950 could increase to 69,798 million in 1955 if all potential demands are connected. The potential increase in residential space heating sales is estimated at 103% and in industrial sales at 71%.

2. Natural gas utilities accounted for 91.5% of all utility sales in 1950; the potential for 1955 is 95.9%.

3. Residential customers will total 26,659,000 at the end of 1955.

4. As for customers, natural gas utilities will be serving 81.6% of the total as against 63.3% in 1950; straight manufactured gas customers will drop from 30% to 5.7%. The number of mixed gas customers will rise.

5. Peak problems will get worse: While residential base load may increase by 49%, residential space heating load may jump 96%, so peak day sales will likely grow from 1950's 19.5 billion to 34.1 billion, a 74% increment; annual load factor for total sales of natural gas will decline from 54.2% to 52.1%; number of residential space heating customers will rise from 9,086,600 to 14,446,800. Eliminating residential users in multi-family dwellings, PAD's experts foresee a "practical" saturation of 77%.

Such an opportunity-filled market is going to be difficult to satisfy. PAD's Deputy Administrator J. Ed Warren says that almost 10 million tons of pipe must be laid in the next three years to accommodate the market, and some sort of controls will have to be retained on the space heating load. PAD Order

No. 2 limiting growth of this market will go off as soon as the "defense need" for it passes, but Mr. Warren believes the states will have to carry on in cooperation with the utility industry.

Heaviest demands for steel pipe, incidentally, will be in the larger sizes. A total of 6.2 million tons of 16-in.-and-up will be needed—a terrific increase over 1952's allocation of 700,000 tons.

Most critical areas will be the Appalachian-Middle Atlantic and the upper Great Lakes region, where presently planned and assured supplies would fall substantially short of peak needs in the winter of 1955-56.

The study should not be allowed to gather dust. Here at last management has a useful chart by which it can set its course for the next three years.

Wages and rates

The chairman of the Wisconsin PSC, John Doerfer, made it clear recently that his agency will not consider pending wage negotiations in connection with rate cases.

The question came up when a local newspaper stated that a recent bus strike in Racine might have been avoided if it had been possible to combine the question of fares and wages in a single decision.

Although agreeing that it would be desirable to settle both questions at one time, Doerfer stated flatly that the PSC could not do so. "It is our considered judgment," he said, "that we should not receive evidence of a pending wage negotiation. That type of evidence is too speculative to form the basis of a reasonable rate structure . . . and it would make the commission a labor arbitrator."

New state legislation in the offing

The Congress isn't the only legislative body presently coming forth with a fistfull of new bills that may affect the gas industry. Several New England state legislators, as well as lawmakers in other states, dropped utility bills in the hoppers as new sessions began.

Massachusetts will consider a bill enabling the state department of public utilities to refund to consumers any amounts refunded to the utility by a pipeline company as a result of FPC action, i.e., rate increases effected under bond but later disallowed.

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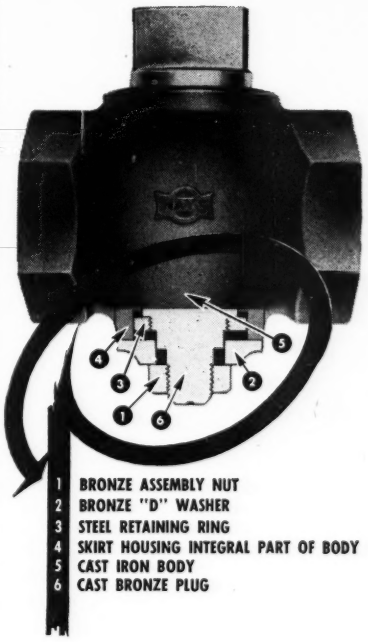
1 BRONZE ASSEMBLY NUT
2 BRONZE "D" WASHER
3 STEEL RETAINING RING
4 SKIRT HOUSING INTEGRAL PART OF BODY
5 CAST IRON BODY
6 CAST BRONZE PLUG

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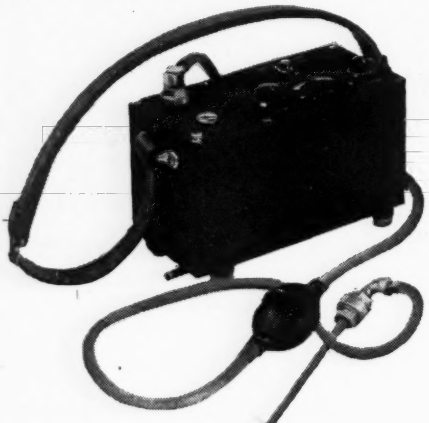

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Democrat, wants changes in state utility regulatory laws to (1) define "fair value" as original cost less accrued depreciation, (2) permit appeals to courts from all orders of the PUC in rate cases, (3) remove from the governor's privileges the right to appoint members of the PUC in favor of their election by the public, with assurance of minority representation, (4) require PUC to hold public hearings on all voluntary rate increases and require issuance of refund script in cases where an increase goes into effect pending further hearings, and (4) force utilities to give notice to municipalities receiving service before making a rate change.

Maryland also may fix utility property value at original cost less depreciation, abandoning the present theory of reproduction cost less depreciation.

A Wyoming bill would divorce PUC from the state board of equalization, making it "fully responsible to the people," with three members elected by the people. Say the authors: "We want an opportunity to vote against the fellows who raise our rates and cost us money."

Connecticut officials are proposing that utilities pay directly for services rendered them by the PUC. Fees would be prorated according to hearing time. A saving to the state of more than $100,000 is reportedly anticipated.

Rhode Island's Governor Roberts promises to bring up legislation "designed to safeguard the public interest" in rate matters. Says he:

"Public utility hearings are often detailed, complex and prolonged. We cannot permit the rights of consumers to be obscured by the sheer bulk of the evidence presented to support rate increases. The consumer's case must be expertly and adequately presented and the facts, favorable and unfavorable to the utility, must be carefully examined. With this in mind we are adding to the technical staff of the Public Utility Administration so that we may properly scrutinize each request for a rate increase presented by a utility company."

Sales Pitches

Report on women's appliance preferences

McCall's magazine's new booklet, "My Kitchen," is a 64-page report on

SAVE HOURS,
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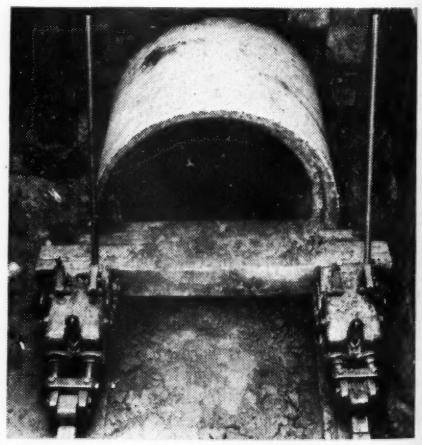
PUSH PIPE UNDER STREETS, TRACKS, walks, floors and other obstacles with a GREENLEE Hydraulic Pipe Pusher. One-man-operated, portable, simple to operate. No tearing up of pavement . . . eliminates extensive ditching, tunneling, back-filling, tamping, repaving. Cuts job time to a fraction. GREENLEE Hydraulic Pipe Pusher often pays for itself on first job. Two sizes—model shown above for pushing ¾ to 4" pipe. Larger unit, below, for pipe over 4", concrete sewer pipe and large drainage ducts. Power pump also available for extra ease and speed of operation.



TOOLS FOR CRAFTSMEN
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home appliance and kitchen equipment preferences of American women, and it's a good one. Based on information compiled during the 1951 "My Kitchen contest," the booklet contains much helpful guidance for salesminded gas industry personnel.

Readers should, however, be prepared for a shock. Electricity very easily won the nod over gas as a favorite kitchen fuel among the modern-minded matrons who entered the competition. When asked, for example, what "type" they had chosen for their remodeled kitchen (a number of types of varying descriptions were included), 25.8% of the respondents chose an "electric kitchen," 5% more than the number who picked a "combination gas and electric kitchen." The "gas kitchen" was the choice of a mere 2.2%.

In choice of fuels for ranges, refrigerators, and water heaters, gas also came off second best. Furthermore, "a higher percentage of those who specify electric ranges *plan to buy them* than do those who intend to *use* gas ranges." While among those who planned to *use* gas refrigerators more planned to buy them than was the case with those who planned to use electric units, nonetheless the situation with water heaters again favored electricity.

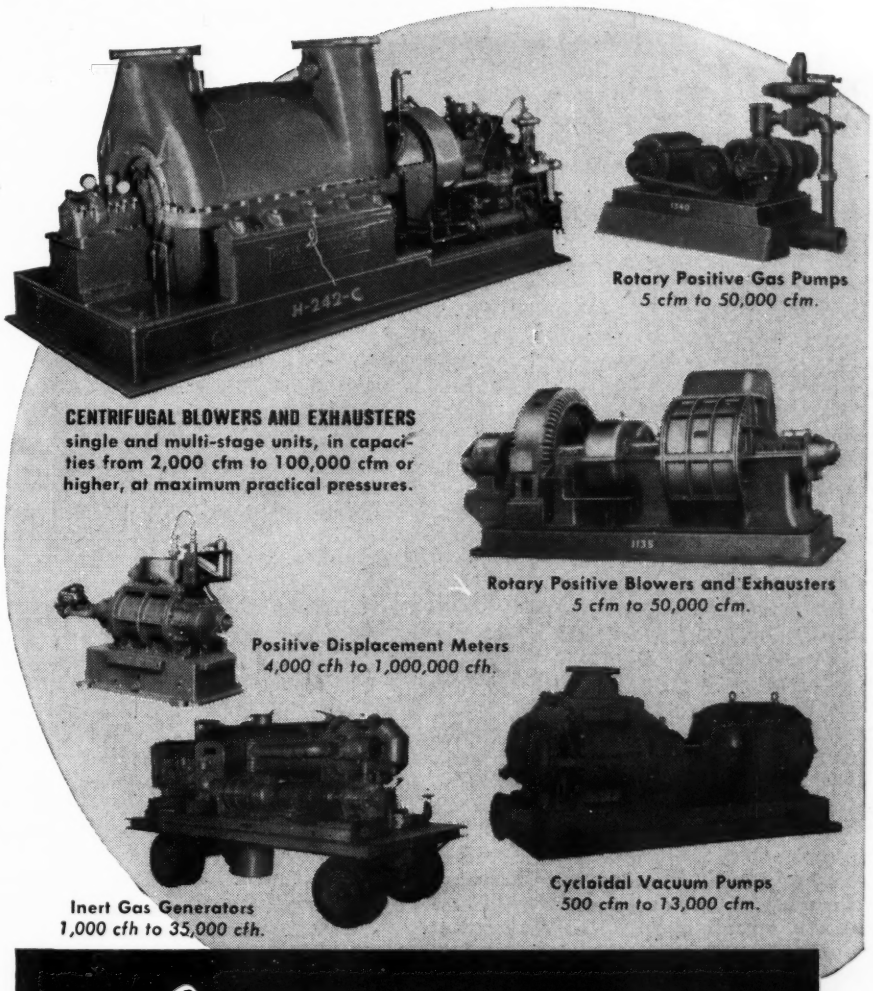
There can be no doubt that brand name identification is an important factor in fuel preference, because the study revealed that there is a greater brand consciousness among those who use electrical appliances. The largest difference between the two fuels in this category was with water heaters, where "nearly 50% more electric users specify brands than do gas users."

Somebody, in the electric appliance business, we suspect, has done a rather better-than-average job of advertising, promoting, and selling his product.

In all fairness, it should be reported that this sideline skirmish between the fuels is secondary to *McCall's* main purpose in publishing the booklet. For kitchen planning departments, it should be a particularly useful work and will probably be on every department's shelf before long.

Nationalization and the British gas industry

The competitive situation might not be too happy here in the U. S., but things could always be worse. All reports from still-nationalized Britain indicate that electricity is running away with the ball.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CALENDAR

February

2-4..AGA Home Service Workshop —Baker hotel, Dallas.

18-19..PCGA Technical Services Conference—Hollywood, Calif.

20..AGA Board of Directors — Hotel Roosevelt, New Orleans.

25-26..PCGA Domestic Sales Conference—Los Angeles.

26..NEGA Accounting Division—Hotel Bradford, Boston.

27..NEGA Industrial Division—Hampshire House, Boston.

March

2-6..American Society for Testing Materials Spring Meeting — Statler hotel, Detroit.

16-20..National Association of Corrosion Engineers — Hotel Sherman, Chicago.

18-19..PCGA Technical Section, Joint Conference, Customers Service and Accident Prevention—Fresno, Calif.

24-25..PCGA Sales Section, Commercial and Industrial Sales Conference—Los Angeles.

26-27..Oklahoma Utilities Assn. Annual Convention — Tulsa hotel, Tulsa.

26-27..New England Gas Assn. Annual Meeting—Hotel Statler, Boston.

30- 1..Midwest Gas Assn. Annual Convention—Broadmoor hotel, Colorado Springs.

April

7-8..AGA Research and Utilization Conference — Hotel Statler, Cleveland.

8-9..PCGA Accounting Section — Phoenix.

13-15..AGA Sales Conference on Industrial and Commercial Gas —Hotel Warwick, Philadelphia.

13-15..AGA Accounting Section, Purchasing and Stores Conference — Shroeder hotel, Milwaukee.

13-16..AGA Distribution, Motor Vehicles and Corrosion Conference—Hotel Sherman, Chicago.

15-16..PCGA Sales Section, Home Service Workshop — Santa Barbara, Calif.

16-18..Florida-Georgia Gas Assn.—Hotel Biltmore, Palm Beach, Fla.

20-22..National Conference of Electric & Gas Utility Accountants—Hotel Sherman, Chicago.

21-23..Southwestern Gas Measurement Short Course—University of Oklahoma, Norman.

23-24..Indiana Gas Assn. Annual Convention — French Lick Springs hotel, French Lick, Ind. (Tentative).

27-29..Mid-West Regional Gas Sales Conference — Edgewater Beach hotel, Chicago.

28-29..PCGA Technical Section, Distribution — San Jose, Calif.

29- 1..Natural Gasoline Assn. of America Annual Convention —Rice hotel, Houston.

30- 1..AGA Transmission and Storage Conference—Edgewater Beach hotel, Chicago.

May

4-5..AGA Eastern Natural Gas Regional Sales Conference — William Penn hotel, Pittsburgh.

4-6..LPGA Annual Convention—Conrad Hilton hotel, Chicago.

4-8..AGA Industrial Gas School—Sheraton-Cadillac hotel, Detroit.

11-13..Southern Gas Assn. — Jung hotel, New Orleans.

11-15..National Fire Protection Assn. — Edgewater Beach hotel, Chicago.

11-15..34th Annual National Restaurant Convention & Exposition—Navy Pier, Chicago.

12-14..Pennsylvania Gas Assn. Convention.

20-22..GAMA Annual Meeting — The Greenbrier Hotel, White Sulphur Springs, W. Va.

25-27..AGA Production and Chemical Conference—Hotel New Yorker, New York City.

27-29..Short Course in Gas Technology—Texas College of Arts & Industries, Kingsville.

28-29..Natural Gas & Petroleum Assn. of Canada — London, Ont., Canada.

June

14-18..Canadian Gas Assn.—Windsor hotel, Montreal.

22-23..Michigan Gas Assn.—Grand hotel, Mackinac Island, Mich.

September

9-11..Pacific Coast Gas Assn. Annual Convention—San Francisco.

11..New Jersey Gas Assn.—Spring Lake, N. J.

October

26-28..AGA Annual Convention — Kiel Auditorium, St. Louis, Mo.

Gas Times, a leading British journal, is campaigning for a reawakening of gas sales forces, and one of its recent editorials brought this comment from a manufacturer:

"Your reference to a 'thin time' by gas appliance manufacturers as a result of the gas industry's lack of activity is a classical example of the English habit of under-statement."

Our own sometime correspondent is also disturbed by what he sees, not only in the competitive picture but in the overall situation:

The coming year shows little prospect of any more favorable outlook for the nationalized British gas industry from the consumers viewpoint. Competition between the gas and electricity industries is still rampant, and a co-ordinated national fuel policy is still far off. Competition should logically be an impetus; the real danger is that underhand tactics are being employed to oust gas from certain fields, and mainly from the domestic field, by the offering of preferential terms for all-electric house construction.

Rising costs continue to force up the price at which gas can be sold. Here again it is a nationalized industry, the coal mining industry, which is responsible for the trouble. Every new wage demand, every increase in transport weakens the ability of the gas industry to sell cheap gas to the consumer.

Transport under nationalization has been equally expensive and has reacted against the nationalized gas industry. There is no evidence that prices can be reduced in 1953; rather the reverse.

The effect of nationalization on personnel has been difficult to assess. It is inevitable that loss of scope for advancement should encourage the more aggressive and alert men to keep out of nationalization; in the same way the second-rate men tend to stay in as long as the industry offers a secure haven where routine performance provides a secure return with a state pension at the end. There is no question but that the state has helped to boost the cost of the commodity to the consumer.

It is not the fault of the personnel in the industry that consumers are still facing a much higher level of cost than is good for progressive development.

All sorts of problems have retarded the opening of new plants, with shortages of steel a major headache. This delay in putting new projects into being is likely to continue into 1953.

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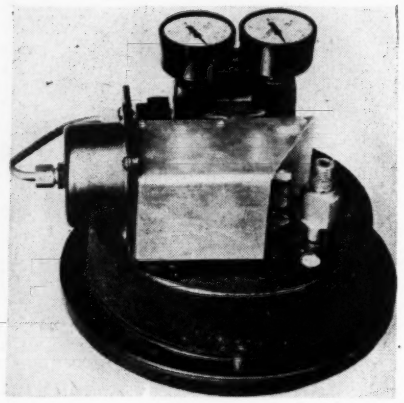


1 Transmitter

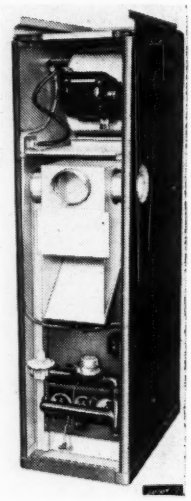
This new transmitter, combining a pressure gauge and a pneumatic transmitter, has an output pressure that varies from 3 to 15 lb (or 5 to 25 lb if specified) regardless of the range of the pressure being measured. The instrument is calibrated with comparison of actual pressure applied to the gauge versus transmitted air. Grade AA gauges are used in either 6- or 8½-in. sizes with Bourdon springs available in a wide variety of materials.

Used with either full size recording receivers or miniature indicating instruments, the pressure pneumatic transmitter provides safety and convenience, particularly where high pressures, corrosive, toxic, flammable or other hazardous fluids are used. The unit permits the use of low pressure air piping to bring pressure indication or recording to any part of the plant. It is suitable for panel, pedestal or wall mounting.

Penn Industrial Instrument Corp.

■

2 Furnace

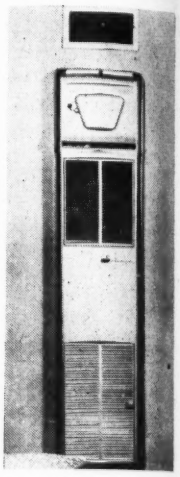


A completely new line of gas and oil heating equipment has been announced by Timken Silent Automatic division. Called Silent Automatic Products, the line includes gas and oil conversion burners; gas sectional furnaces of the Lo-Boy, Hi-Boy, and Counter-Flo types; gas sectional boilers for both steam and hot water; and a series of furnaces interchangeable for oil or gas.

Illustrated above is one of the new units, a Counter-Flo furnace having three capacities ranging from 75,000 to 125,000 Btu per hour. This model has been designed for installation on non-combustible flooring and is approved for close-clearance installation.

Timken Silent Automatic Div.

3 Wall Heater



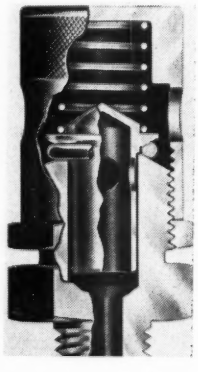
A new line of gas-fired wall heaters gives the installer the choice of up to 24 different combinations to solve a maximum variety of heating problems. There are six basic models, four of them single-wall and two dual-wall with input ratings of 25,000 to 55,000 Btu. The variety of combinations is made possible with the three-speed Directionair blower, rear register, and Economizer grille and stack assembly.

The blower, optional for all models, takes in room air near the ceiling, mixes it with freshly heated air at the heater outlet, and forces the tempered air directly to the floor. The rear register gives dual-wall advantages to single-wall models and the Economizer is a high-level assembly that reclaims waste heat.

Coleman Co. Inc.

■

4 Relief Valve



Designed for controlling gases safe to release into the atmosphere, a new adjustable low pressure, relief-type valve provides protection in systems where leakage cannot be tolerated or is undesirable.

Featuring the "Circle-Seal" principle, the valves are available for relief pressures from 2 to 45 psi with adjustments preset at the factory or by the user. Supplied in either aluminum or brass, the valves have ⅛-in. or ¼-in. male pipe connections.

Units in production have operating temperatures ranging from 40° to 280°F. How-

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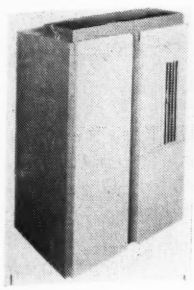
ever, O rings for temperatures as low as -80° or as high as 400°F can be furnished. The Circle-Seal principle employed is a resilient, standard, easily replaceable O ring, self-aligning between two conical seats of a poppet type valve.
James-Pond-Clark

■

5 Air Conditioner



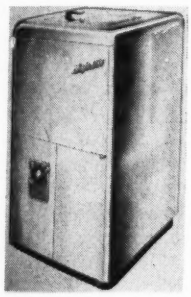
Over 190 models in a wide range of heating and cooling capacities are available in a new air conditioning line designed to fit the year-round indoor climate requirements of any size house in any part of the country.

The air conditioners are completely self-contained packaged units finished in two-tone gray. The flexibility and wide range of choice is also carried out in the fuel, with either gas or oil firing available. Compactness is featured in the line, the smallest unit taking up 8.3 sq ft of floor space and the largest occupying 15 sq ft.

Each model has a factory-sealed refrigeration system on a new hermetic compressor.
General Electric Co.

■

6 Incinerator



An automatic gas-fired indoor incinerator is now available that incinerates all wet and dry garbage and trash-burner waste. No special preparation of the garbage or trash is necessary before putting it into the unit. The new approved unit has been designed to harmonize with other household appliances. The vent pipe taps right into the furnace flue.

Actual burning takes place in an inner shell within the outer casing. By an arrangement of baffles, air that enters the bottom of the unit rises between the two casings while a controlled amount of air enters the incinerator at the top, drying the charge between firings and providing oxygen for combustion during firing. A venturi type flue outlet produces the exclusive Jet-Air action, available only in the Majestic incinerator.

Radiant shielded fiber-glass insulation is also featured. There is no smoldering and the residue from each burning falls down to or through a special V-shaped sloping grate that eliminates surfaces where unburned material might gather and choke off the draft.
Majestic Co. Inc.

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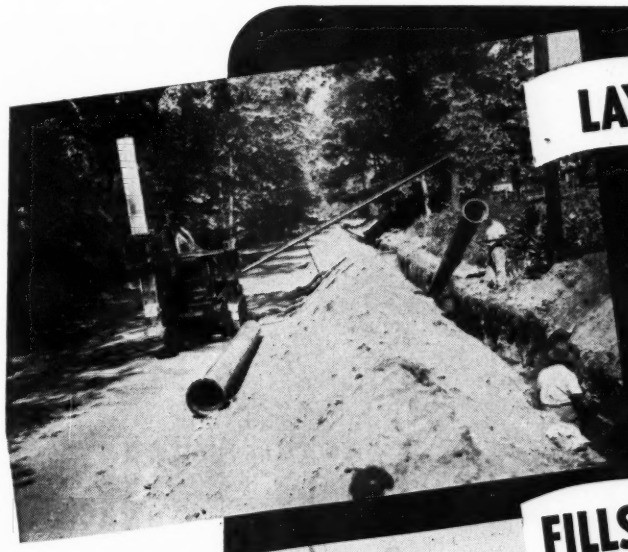
with just 1 man



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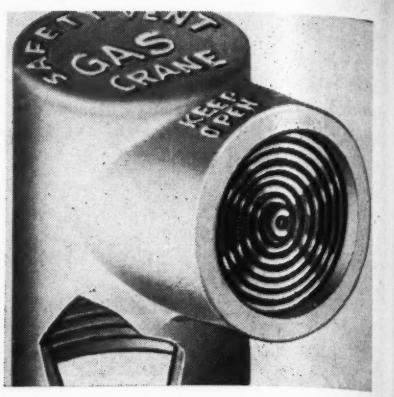
7 Manometer

A new series of flexible slack-tube manometers, equipped with a convexed spring-steel scale for rigidity in use and flexibility for convenient carrying, has been introduced. The manometer, available in standard ranges from 8 in. to 10 ft in water or mercury, can be rolled up into a small unit to fit into pocket or service kit. The body is made of vinyl plastic. It can be rolled, twisted or bent into any shape and will return to a full-length, easy-to-read and accurate U tube.

F. W. Dwyer Manufacturing Co.



8 Vent Elbow

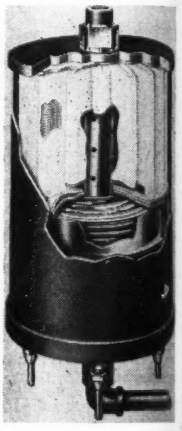
A new safety gas vent elbow featuring a non-clogging coil spring screen has been introduced for use on regulator vent lines on high pressure mains. Manufactured in ¾-in. size, the elbow is die cast of zinc alloy. Instead of having a bar grate, the outlet opening is fitted with a stainless steel coil spring that fits snugly and securely into a cast recess around the inner periphery and a short distance back from the end of the opening. An integrally cast cross bar back of the spring makes it impossible to push the spring back into the fitting.

The coil spring acts as a flexible screen, the space between the spiral windings of the coil being small enough to keep out foreign matter which might clog the opening.

Crane Co.

■

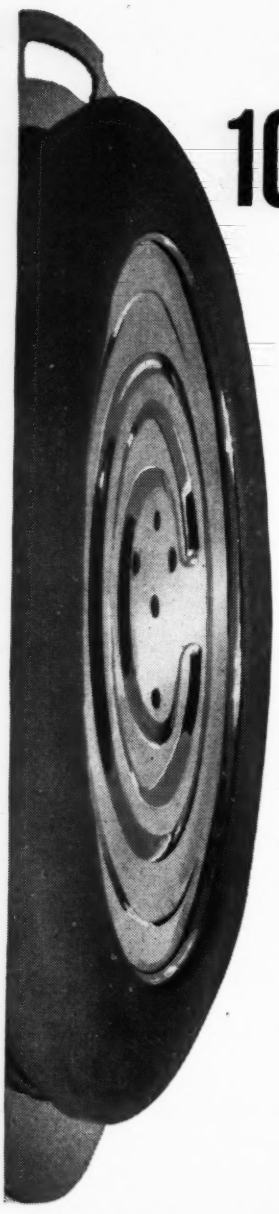
9 Filter



Developed as an improvement of a previous model, the new Hankison Condensifilter provides compressed air of "instrument quality" by dehydrating and filtering ordinary plant air. The outstanding feature is the filtering unit. It is made of wire mesh, to which flannel is securely attached, and has a cartridge with a radial fin design which provides over 540 sq in. of filtering area. The dew point of the air is lowered to within 2 or 3° of the cooling water temperature as it passes over the 400-sq in. surface area of the condenser.

A float-operated, snap-action trap is an integral part of the condenser, through which accumulated condensate is discharged. The rated capacity of the new Condensifilter is 30 scfm at 100 psig. Greater capacities can be provided by installing the required number of units in parallel. Some uses of the condenser are in the control of soaking pits, blast furnaces and open hearths.

Hankison Corp.



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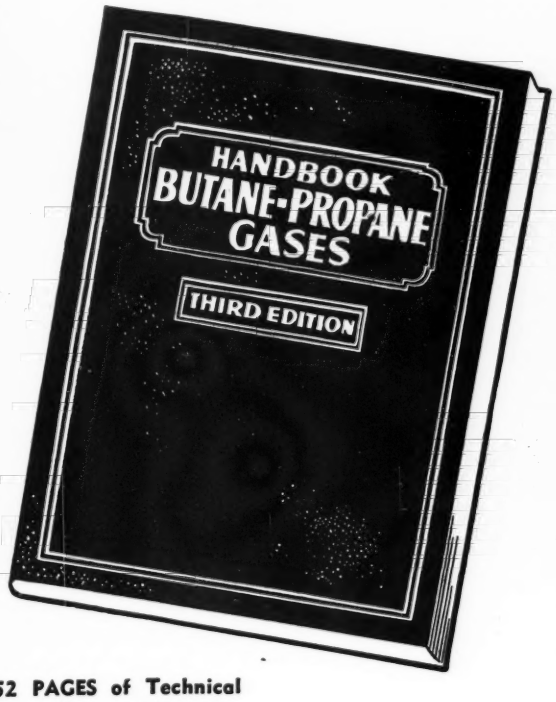

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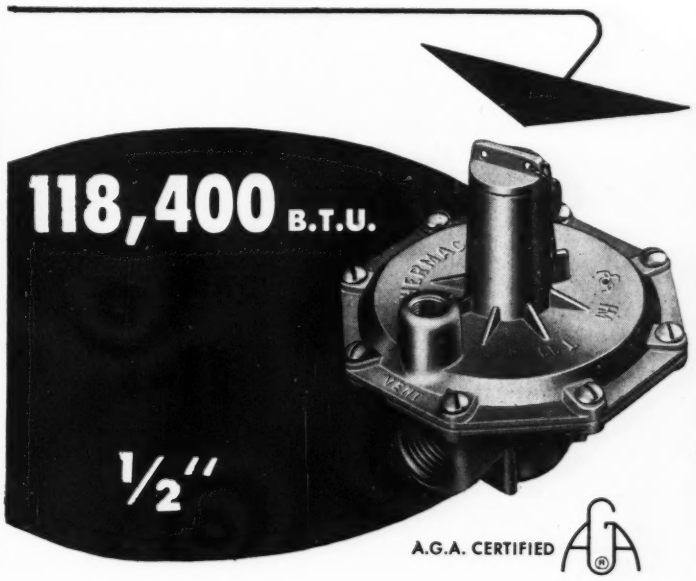

Greater BTU capacity per size, extremely accurate pressure control plus a lower cost unit are outstanding advantages of Thermac Regulators Take the new ½" "T"Series for example. This regulator with a capacity of 118,400 BTU measures only 3-9/16" in width. Other sizes are proportional ranging in capacity from 9000 to 1,398,600 BTU.

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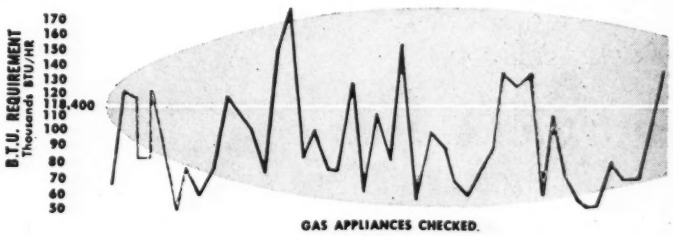
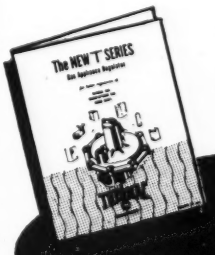


The octagonal shape makes installations in tight spots a cinch. We have also added vise grip bosses to aid assembly. Then too, the cover vent may be tapped to receive your particular connection thereby eliminating need for extra fittings. In the new "T" series you have a small regulator with more capacity at a lower price plus a lower installed cost. Send today for new illustrated literature.



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Trade Literature

10 Insulation Bulletin

Insulating meter nuts and pipe unions used to isolate gas pipelines and to break electric currents in cathodic protection systems are described in a new four-page bulletin. Four types of insulation are discussed and illustrated, and a specification table is included.

Universal Controls Corp.

■

11 Pipe Brochure

A new 16-page brochure contains information on four types of plastic pipe: flexible, semi-rigid, rigid high impact, and rigid polyvinyl chloride. Detailed tables give chemical and physical characteristics of each type and directions are presented for installation and joining of the pipe.

Triangle Conduit & Cable Co. Inc.

■

12 Hammer Bulletin

Application of portable gasoline-powered hammers in the utility, telephone, factory maintenance, and general construction fields are described in a new bulletin. Typical applications include concrete breaking, asphalt cutting, frost breaking, ground rod driving, and a variety of utility jobs. Various models are described and specifications are given.

Barco Manufacturing Co.

■

13 Dehydrator Bulletin

Selas has published a new bulletin, "Selas Dehydrators," describing the continuous removal of water vapor from air and other gases, to dew points as low as —100° F. Three series of dehydrators are fully specified as to capacities and physical dimensions and a nomograph is provided for preliminary determinations of appropriate equipment. The bulletin also describes the needs for dehydration and the extent to which gas or air can be dried, practicably, together with the operation of specified equipment.

Selas Corp. of America

■

14 Technical Bulletin

A new technical bulletin on the ethanolamines—mono-, di-, and triethanolamine—widely used in the purification of gases, has just been published. Chemical, physical, and physiological properties are presented, together with shipping data and applications in all branches of manufacturing and processing industries.

Carbide & Carbon Chemicals Co.

■

15 Control Bulletin

A new bulletin for control station planners discusses the engineering and economical planning of combustion and process control panels. Panel designs are illustrated together with up-to-date methods of tubing and wiring. A section on accessories is included.

Bailey Meter Co.

■

16 Catalog Digest

A catalog digest featuring an indexed selection guide, describes a complete line of bronze, iron, cast, and forged steel valves. Pressure-temperature rating charts and trim charts for both forged and cast steel valves are included in addition to a pressure-temperature chart for composition disc application in bronze and iron valves.

Ohio Injector Co.

■

17 Tube Bulletin

Advantages to be gained by installing precision bored tubes in connection with flow meter orifices for measurement of natural gas are presented in a new bulletin. The precision machine bored meter runs give standardized performance of measurement and permit the use of any beta ratio.

Dravo Corp.

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NEWS

Gas companies report record-breaking year

Gas utilities around the nation last month were engaging in the favorite turn-of-the-year pastime of announcing that one record-breaking year was yielding to another.

Scattered reports showed that, construction-wise, 1952 was an exceedingly large year, and that 1953 will be comparable. For example:

Southern California Gas Co., Los Angeles, has set its construction budget at approximately $35 million, the seventh year the budget has exceeded $25 million. The major portion will go toward bringing service to new customers, averaging about 50,000 a year. Southern Counties Gas Co., also of Los Angeles, expects its customer expansion to be about the same as '52; that is, an addition of 25,000 new meters.

Consumers Power Co., Jackson, Mich., will spend $58 million in 1953, the largest amount in the company's history. Natural gas expansions and improvements will garner $12.5 million of it. Since the end of the war, Consumers Power has spent $338 million on expansion.

Colorado Interstate Gas Co., Colorado Springs, plans to add a compressor station, increase the horsepower, and complete a loop line with the $12 million allotted for 1953.

Public Service Electric & Gas Co., Newark, N. J., has set a budget of $90 million for gas and electric construction programs. Additions and improvements at gas plants, construction of gas mains and reinforcements of existing mains will take the greatest one-year financial outlay in company history.

The Gas Service Co., Kansas City, Mo., has a new 5-year plan to spend approximately $19 million to expand its distribution system. In the past five years, capital expenditures for expansion and improvements in the distribution system amounted to $23 million. Investment in distribution properties and facilities totaled $60 million. During the same period, customers increased 106,000 for a total of 444,925.

Consolidated Gas Electric Light & Power Co., Baltimore, has upped its budget to $30 million for construction and expansion of its facilities in '53; in '52, $28 million was spent.

Pacific Gas & Electric Co., San Francisco, has had capital expenditures since the end of World War II of $980 million. In 1952, $160 million was spent and at least that amount will be spent this year. Of that, $32 million will be for expansion of gas facilities. 1952 was the sixth consecutive year that PG&E added more than 100,000 new gas and electric customers.

Philadelphia (Pa.) Electric Co. has spent and expects to spend an average of $1 million a week from 1946-1956. In the next four years close to $258 million may be spent for system expansion and reinforcement.

Peoples Natural Gas Co., Pittsburgh, will use over $3 million of an expected $7,993,000 1953 budget for improving its divisional distribution units. The company expects to send out an increase of almost 8.5 billion cu ft during the next 10 months.

New York State Natural Gas Corp., Pittsburgh, spent approximately $20,374,000 in improving and expanding its facilities during 1952 and expects to spend an additional $7,774,000 during 1953.

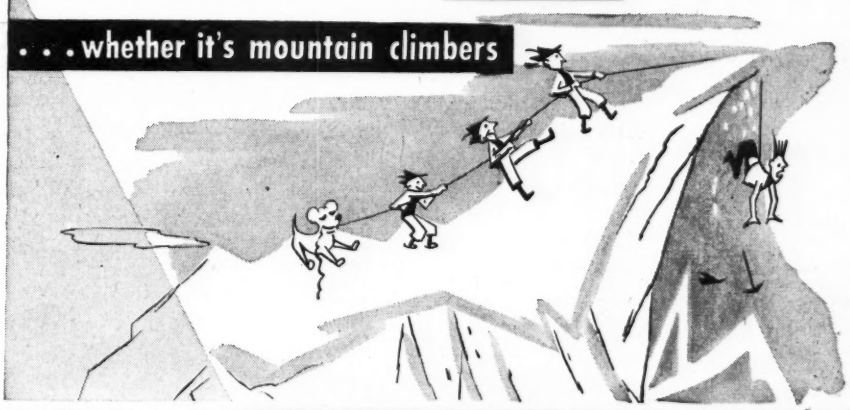
Laclede Gas Co., St. Louis, spent over $6 million on improvements in 1952; this year $4.5 million will go toward expansions.

In Dallas the Lone Star Gas Co. added 96 miles of mains to serve 8000 new customers and this year will spend about $3.3 million to enlarge facilities, distribution mains, customer meters, service lines, etc.

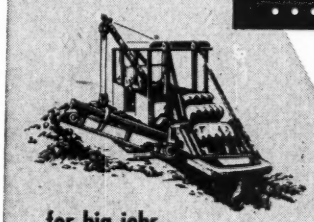
Despite Brooklyn Union Gas Co.'s conversion to natural gas, it was a good year for househeating. Statistics show that every month of 1952, beginning with June, netted

It takes a FULL team

. . . whether it's mountain climbers

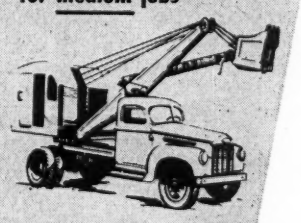


. . . or digging equipment



for big jobs

for medium jobs



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a gain in this category over the corresponding month of 1951. For 1953 the goal has been set at 10,000 new househeating jobs, representing a 100% increase in normal sales over 1952.

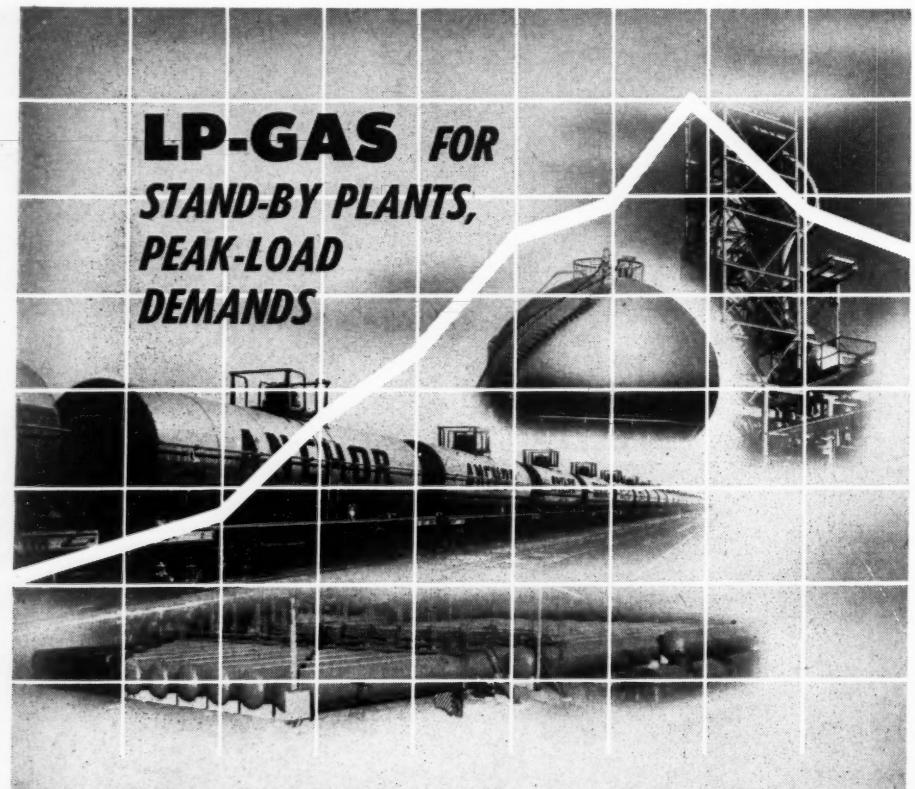
Gas supply to city cut off by line break

More than 15,000 homes and business establishments in St. Joseph, Mo. were left without gas for heating and cooking purposes late in December when a line break in the main supply line cut off the gas supply to the city of 80,000 residents.

A state of emergency was declared in the city, and public buildings opened their doors to residents whose homes went unheated in the freezing and near-freezing weather; hotels with dual-fuel equipment housed many residents; and radio stations, the local Civilian Disaster Relief Corp, nearby utilities, and local power companies, all lent assistance.

The break occurred in the 12-in. transmission line on the afternoon of Dec. 20 and by the evening of Dec. 23, some 20,000 meters had been turned off and equipment checked before restoring pressure, although the break was repaired immediately.

Company officials report the break may have been the result of last April's flood waters that weakened the line. At that time more than 80 ft of the pipeline was exposed in a washout near the breaking point.



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New York companies' merger gets state approval

C. L. Hulswit

After three attempts to get state PSC permission, the right to merge has been granted Rockland Gas Co., Spring Valley, N. Y., and Rockland Light & Power Co., Nyack, N. Y. As a result of the merger, rate reductions are expected for some customers. The state PSC cited this and the desirability of pooling gas supplies as reasons for approving the latest request.

Rockland Light, by purchasing its neighbor, Rockland Gas, added 14,000 gas customers for a total of 26,500. In addition, Rockland Light has 62,000 electric customers.

Charles L. Hulswit, president of Rockland Gas for the past 15 years, has become a vice president and a director of the power company. Fremont L. Lovett is president of Rockland Light.

New division opened by Southern California Gas

Keeping pace with the rapid population growth in southern California, early in January Southern California Gas Co., Los Angeles, officially opened its newest division, the northeast, in Pasadena, Calif.

In addition to the headquarters building, the division, under the management of Myron G. Thomas, has four commercial offices in neighboring communities and two operating bases. The division started its existence with approximately 113,000 meters, and is located in an area where, since 1940, residential development has increased approximately 50%.

RCA Estate introduces first ranges at show

The RCA Estate Appliance Corp., a newly formed subsidiary of the Radio Corporation of America, introduced the first gas ranges to bear the RCA monogram at the Chicago Furniture Mart last month.

Headed by President Cecil M. Dunn, RCA Estate was formed late last year when negotiations were completed for RCA's acquisition of the Estate Stove Co., Hamilton, Ohio, long-time manufacturer of gas and electric ranges.

Gas Supply Co. approved as utility operation

The Gas Supply Co. of California, a newly incorporated subsidiary of Pacific Lighting Corp., both of San Francisco, has received its certificate of public convenience and necessity from the California PUC permitting the new company to operate as a public utility. It will also operate and maintain the properties to be acquired from Pacific Lighting Gas Supply Co., a non-public utility.

The acquired properties are to be dedicated to public use for the first time and will sell natural gas under contract to Southern California Gas Co. and Southern Counties Gas Co. both of Los Angeles, for resale.

In an additional order, the public utilities commission found that the parent company, Pacific Lighting Corp., is not a public utility and dismissed its investigation proceedings instituted in November 1951.

Operating revenues up in October, reports FPC

Operating revenues of natural gas companies reporting to the FPC for the month of October 1952 totaled $151,565,243, an increase of 25.6% over the same period in 1951. For the 12 months ended Oct. 31, revenues aggregated $1,816,616,629, a 16.9% gain over the year ended Oct. 31, 1951.

Utility operating incomes for October 1952 amounted to $15,859,051, up 32.6% from the $11,975,606 reported for October 1951. The figures for the 12-month period showed $268,505,515 in 1952, an increase of 9.8% over the $244,514,980 in 1951.

Net income for October 1952 was $10,998,721, up 58.2% from the October 1951 net of $6,954,517. For the 12-month period ending in October, net income of $201,187,137 represented an increase of 6.3% over the comparable period ended in October 1951.

Metals company sponsors three welding clinics

A series of three welding clinics, open to all production men, welding engineers, and others interested in the fabrication of metals, will be held in Salt Lake City, Los Angeles, and San Francisco this month by Pacific Metals Co. Ltd., San Francisco.

Welding experts of leading metal companies as well as producers of welding and accessory equipment will participate. Participants include International Nickel Co., Aluminum Co. of America, Lukens Steel Co., Revere Copper & Brass Inc., Crucible Steel Co., Welding Fittings Corp., A. O. Smith Corp., the American Platinum Works, and Linde Air Products.

Each clinic will last for three days. The first is scheduled for Salt Lake City, Feb. 2-4; the second in Los Angeles on Feb. 11-13; and the third in San Francisco, Feb. 18-20.

ConEd gets PSC approval to convert wider area

Consolidated Edison Co. of New York has received approval of the state PSC to convert the Riverdale-Marble Hill area in the Bronx and Manhattan to natural gas. The conversion will affect about 18,000 customers and cost an estimated $520,000.

ConEd's original request was denied by the PSC in 1951 without prejudice to renewal of the petition until such time as the company had adequate standby facilities or an alternate line leading into the metropolitan area. Since then a second line from New Jersey across Staten Island and under the Narrows to Brooklyn has been completed. (See January *GAS*).

Cascade Natural Gas Corp. incorporated in Seattle

With an authorized capital stock of $6 million, the Cascade Natural Gas Corp. was incorporated early in January by three Seattle attorneys. The firm's purposes were given as the manufacture, transport, purchase and sale of natural or manufactured gas, oil and petroleum products. Proposals

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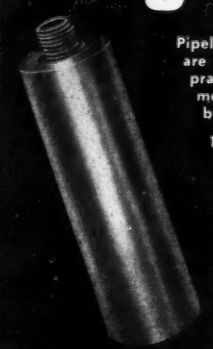

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4. Minimum Delay in supplying any size or shape anode required.

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PIPELINE SUPPLY COMPANY, 2230 Magnolia Street, Birmingham, Alabama
PROTECTO WRAP COMPANY, 436 Douglas Blvd., Los Angeles 12, California

to construct and maintain pipelines were also included in the incorporation papers filed with the secretary of state in Olympia.

The incorporators are H. B. Jones Jr., R. P. Hooper, and Richard I. Sampson, all members of the law firm of Jones, Birdseye & Grey.

UGI names vice presidents to head six divisions

Six presidents of former subsidiaries have been elected vice presidents of United Gas Improvement Co., Philadelphia, to head new divisions resulting from the merger into UGI of all its operating utility subsidiaries.

Vice presidents and their divisions are: John A. Brick, Lehigh Valley Gas division, Allentown; Andrew S. Morgan, Lancaster County Gas division; Leonard B. Richards, Harrisburg Gas division; Allyn C. Taylor, Reading Gas division; and Charles E. Warsaw, Luzerne Electric & Gas division, Kingston. Hudson W. Reed, who has been a UGI vice president since 1949 and president of the Philadelphia Gas Works Co., will be in charge of operations in the Philadelphia Gas Works division.

In announcing the elections, Walter E. Long, UGI president, also announced the completion of arrangements for the merger made in order that UGI may conduct all operations as a single company.

Secretary Chapman names 1953 gas advisory council

Secretary of the Interior Oscar Chapman has appointed 65 men to serve on the 1953 gas industry advisory council, the group that advises the secretary and PAD on gas matters involved in national defense.

Of the total, 61 members were reappointed. The four new members are: Robert W. Otto, Laclede Gas Co., St. Louis; Frank C. Smith, Houston (Texas) Natural Gas Co.; Norman B. Bertolette, Hartford (Conn.) Gas Co.; and John A. Weiser, Newport (R. I.) Gas Light Co.

Activated carbon produced at Girdler's new plant

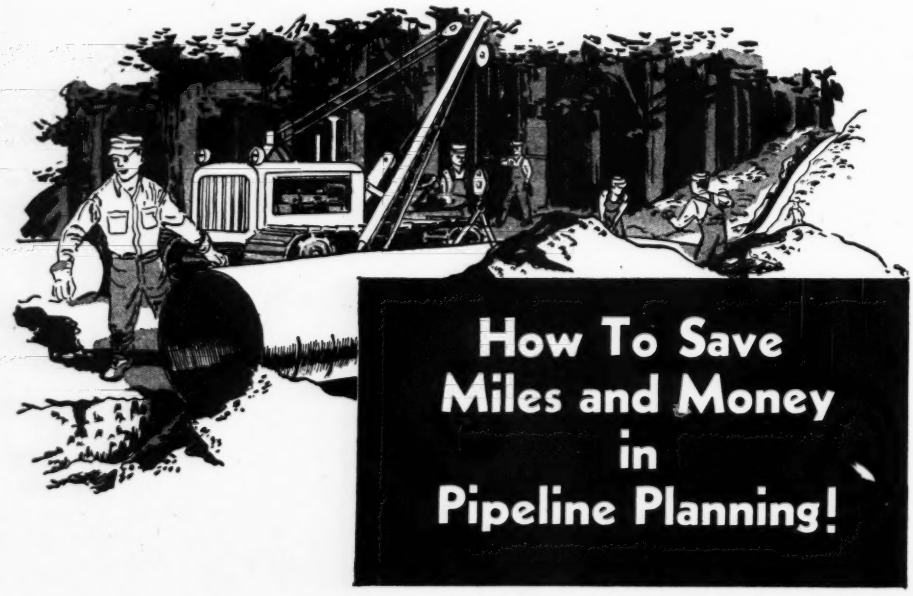
The new plant of the Girdler Corp. at Louisville, Ky., was put into operation late last year for the production of activated carbon from hardwood char. New developments in the plant are a part of a continuous process for the manufacture of several types of activated carbon. Means have been provided for producing carbon of uniform physical characteristics and high absorptive capacity.

Girdler's activated carbon, G-25, is used for the removal of sulfur compounds and other impurities from gas streams and as a catalyst or a catalyst support.

In commemoration of the installation of the 100,000th meter by Brooklyn (N. Y.) Borough Gas Co., C. B. Dushane (right), American Meter Co. vice president, presented a gold plated meter to Walter M. Jeffords, Jr., president of the gas company.

OPS authorizes 6% boost for coal tar processors

Coal tar processors last month received OPS authorization to increase ceiling prices on their products by an amount averaging 6%. Higher labor, material, and other costs, resulting in a decline in industry earnings below the minimum considered "fair and equitable" under the Defense Production Act, were cited as reasons for the increase, which may amount to between $7 and $8



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Abrams surveys do save miles and money—one client recently reported saving 1½ miles of line in just one 12 mile section—a saving that paid for the entire survey many times over.

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million, according to an estimate of last year's total business.

Another provision permits by-product coke oven operators to propose alternate periods for computation of revised ceiling prices if either of the prescribed reference periods relating to their coal costs is abnormal because of strikes or other unusual operating experience.

News Notes

A strike of some 500 white collar employees, members of an independent union, at the Milwaukee Gas Light Co. last month threatened to develop into a complete work stoppage when CIO production and maintenance workers refused to cross the picket lines. However, CIO union leaders urged members to return to work under the terms of their contract with the company and a serious emergency was narrowly averted.

The AGA reports that sales of the gas utility industry to ultimate customers during last November aggregated 4600 million therms, an increase of 9.8% over the 4189 million in November 1951. The 12-month sales were 51,508 million therms, up 7.7% over a year earlier. The increase is attributed to the constantly growing number of new gas customers and to increased consumption of gas by industrial consumers.

On the losing side of Federal Judge William Atwell's decision in its patent infringement case against Bryant Heater Div. (see January *GAS*), the A. O. Smith Corp. has appealed the case to the Fifth Circuit Court of Appeals. According to Smith attorneys, the appeal on the judge's verdict in the suit involving allegedly patented water heaters will probably be taken up in April or May.

The Public Utilities Commission of Ohio has announced a new policy designed to speed up its administrative machinery by eliminating informal talks on matters after they have been assigned a formal docket number. Heretofore, any attorney could talk with any commission member at any time on any subject.

Motorola Communications & Electronics Inc., a new wholly owned subsidiary corporation, has been organized by Motorola Inc., Chicago, to distribute complete mobile two-way radio systems, multi-channel microwave relay systems, power line carrier, supervisory and industrial control equipment.

A limited number of GAMA's "Directory of Local Housing Authorities" are available for $1 each from GAMA at 60 E. 42nd St., New York. Forty states and the territories are included together with a list of Public Housing Authority field offices.

The Pennsylvania Public Utility Commission was restored to its full complement last month when Governor Fine appointed Thomas C. Egan and P. Stephen Stahlnecker to the commission. Both men served on the PUC's predecessor, the state public service commission.

Three utilities in the New York City metropolitan area were authorized last month to add 8700 new gas-heating customers because of the assurance of an adequate gas supply as a result of the completion of the new pipeline across the Narrows. Brooklyn Union Gas Co. will handle 6000 new services; Long Island Light Co., 2500; and Brooklyn Borough Gas Co., 200. Iroquois Gas Co., Buffalo, was also authorized to connect 10,000 new space-heating customers.

The Seattle Gas Co.'s application for an additional franchise to install gas mains in rural King county probably will be granted by the Board of King County Commissioners. The board indicated it would approve the franchise, possibly for piping natural gas into Seattle, but postponed its final decision.

Allis-Chalmers Manufacturing Co., Milwaukee, has appointed the Valley Equipment & Supply Co., Burbank, Calif., a distributor in Los Angeles county for its motors, controls, transformers, and "Texrope" drive equipment.

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People

Promotions

H. L. FARRAR has resigned as president of Coast Counties Gas & Electric Co., San Francisco. Mr. Farrar, president since 1934, will devote more of his time to his duties as vice president of Coast Counties' parent, Pacific Public Service Co. J. K. HORTON, chairman of Coast Counties' board, succeeds him as president.

THOMAS A. COLLINS, executive vice president of Glass Fibers Inc., Toledo, has been named general manager. He will coordinate production, sales, advertising, and public relations activities.

Whirlpool Corp., St. Joseph, Mich., has appointed THOMAS J. LOUNSBERY to the post of sales promotion manager of the washer division and BERNARD COLLINS and CHARLES W. REXFORD as new regional sales managers.

J. H. WALTERS, formerly Houston gas sales supervisor, has been named Houston district sales manager of Rockwell Manufacturing Co., Pittsburgh. He will be responsible for the coordination of all meter and valve division sales in the district covering Texas and Louisiana.

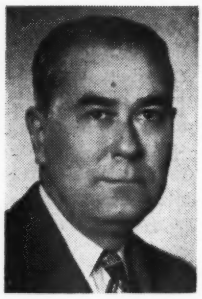
H. L. Farrar
Coast Counties

J. H. Walters
Rockwell

CARL N. BROWN has been appointed sales manager for cast iron pipe in the United States Pipe & Foundry Co., Burlington, N. J. Mr. Brown has held various sales positions with the company since 1925, most recently serving as assistant general sales manager.

DAVID A. LEWIS has been elected as vice president in charge of general operations of the New York State Electric & Gas Corp., Binghamton, N. Y. He has been general operating superintendent since 1949.

Changes at Consolidated Edison Co., New York, include election of KENDRICK F. BELLOWS as assistant vice president; L. A. SCOFIELD, ConEd vice president in charge of Westchester administration, will take over direction of the company's sales department while retaining his present responsibilities.



D. A. Lewis
N. Y. State

C. N. Brown
U. S. Pipe

As vice president, HARRY J. BAUER will be reported to by the departments of insurance, real estate, transportation, and commercial buildings. MRS. KENNETH B. NORTON, a trustee of ConEd since 1938, has resigned her post. CHARLES EDLUN, vice president and treasurer of Staten Island Edison Corp., was elected an assistant secretary of the parent company.

Promotions in the law department of Public Service Electric & Gas Co., Newark, N. J. included ALLEN CRAFT, assistant general counsel, and FREDERICK M. BROADFOOT, attorney.

T. H. EVANS has been promoted to vice president in charge of sales for Equitable Gas Co., Pittsburgh. WALTER C. BOMHOFF succeeds Mr. Evans as vice president of Kentucky West Virginia Gas Co., Ashland, Ky.

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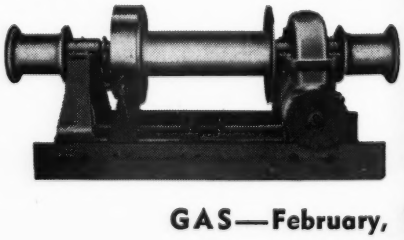

M. M. PEARS, engineer in the distribution department of Equitable, succeeds Mr. Bomhoff as manager of planning and development for both Equitable and Philadelphia Oil Co.

ALVIS D. BOURLAND has been appointed manager of Lone Star Gas Co.'s McGregor, Texas subdistrict, replacing PAUL C. LANE, who has been transferred to the Gatesville district.

JOHN B. SIMPSON, assistant general superintendent of Michigan Gas Storage Co., has been appointed to the newly created post of assistant general supervisor of gas operations for Consumers Power Co., Jackson, Mich. General supervisor of gas operations is vice president DON E. HERRINGSHAW, who is also a vice president of Michigan Gas.

C. L. Stone

J. K. Van Leeuwen

Two new regional managers have been named for Sherman Products Inc., Royal Oak, Mich. J. K. VAN LEEUWEN, as eastern regional manager, will supervise the territory east of the Mississippi river while C. L. STONE, western regional manager, will cover the territory west of the Mississippi.

M. F. GRACE, recently returned from duty in Korea, has been put in charge of the Texas division of Robertshaw Thermostat division, Robertshaw-Fulton Controls Co. The newly created division includes the states of Oklahoma, Texas, Arkansas, and Louisiana.

J. F. KNOFF has been appointed as vice president and general sales manager of the Chrysler Airtemp division, Dayton, Ohio. Since 1951 he has been general sales manager.

JOSEPH BECKER, one of the nation's foremost authorities on chemical-recovery coke oven design, construction, and operation, has retired as vice president and general manager of the engineering and construction division of Koppers Co. Inc. However, he will remain active in a consulting capacity. Mr. Becker first became affiliated with Heinrich Koppers in Essen, Germany, in 1906. In 1910 Koppers selected him to be chief chemist for the new American branch office, later becoming general superintendent for Koppers construction work in the U. S. Among his inventions are those which allowed building larger ovens with better

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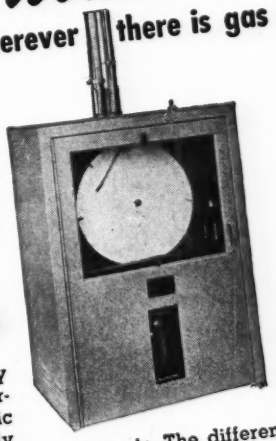

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This new Arcco-Anubis Dry Air Gas Gravitometer determines and records specific gravity of gases automatically corrected to the humidity content of the air. The difference in weight between a column of GAS and equal column of DRY AIR is measured. This ratio represents the true specific gravity of the sample.

One bell of the instrument is filled with gas which is being measured, and the other bell is filled with dry air. Otherwise, except for the new instrument having one column for gas and one column for dry air, the unit is identical in operation to the standard gas gravitometer. When calibrated and properly installed, these instruments require little attention other than to wind the clock, ink the pen, and change the chart. Send for bulletin No. 101.

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heating systems and the design of special ovens which would coke coal formerly considered non-coking, the latter having contributed appreciably to the establishment of a Western integrated steel industry. GEORGE M. CARVLIN, vice president and assistant general manager of the engineering and construction division of Koppers, succeeds Mr. Becker as general manager.

With the retirement of T. B. GENAY on Dec. 31 CHARLES A. MENGERS was appointed engineer of gas design for United Engineers & Constructors Inc., Philadelphia. In 1920 Mr. Genay joined the gas department of the UGI Contracting Co., later United Engineers, and became engineer of gas design in 1928. Mr. Mengers also started with UGI Contracting.

BERT COLE has been appointed regional manager for Servel's eastern region with headquarters in New York City and WILLIAM K. GRUBE is managing the midwestern region, with headquarters in Chicago. Mr. Grube succeeds PAUL R. KENNEDY, who is now in charge of the company's contacts with public utilities throughout the Southwest, while Mr. Cole succeeds GORDON J. MALONE who was recently named manager of Servel's home freezer sales. Sales division changes include naming DONALD R. MECKSTROTH to the post of manager of sales operations. ROBERT B. ROBINSON, formerly sales research manager, succeeds him as director of marketing services.

Bert Cole

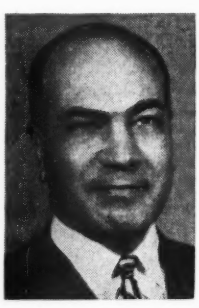
W. K. Grube

R. W. HESTER has succeeded D. W. ROBINSON as superintendent of gas and water properties of Community Public Service Co., Fort Worth. Mr. Robinson, who will serve as a consultant on engineering problems with CPS, has joined a firm of consulting engineers.

ARNOLD I. THORSEN, Norwood works manager, Allis-Chalmers Manufacturing Co., has been named assistant director of manufacturing of the company's general machinery division. He returns to Milwaukee after being at the Norwood works for 12 years.

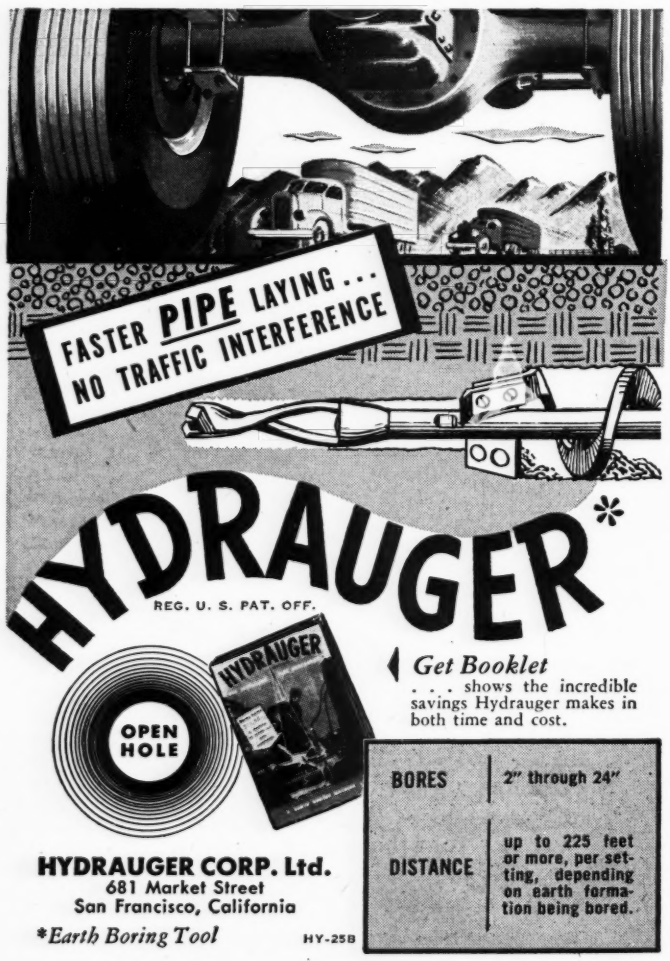
T. A. JONES and ALLAN ANDERSON have been promoted to the field sales staff of the home appliance division of Hamilton Manufacturing Co., Two Rivers, Wis. Mr. Jones has been tentatively assigned to the eastern territory and Mr. Anderson to the southern territory.

R. M. MARBERRY has been promoted to the position of national sales manager, Timken Silent Automatic Products, Timken Silent Automatic Div. He has been merchandising manager of the division since 1951. RICHARD E. LOEBELL has been named national sales manager for a new line of gas and oil heating equipment, to be called silent automatic products. Mr. Loebell's former affiliations include Chrysler Air-Temp, Bryant Heating Corp., and Ingersoll Products Div.



R. E. Loebell

R. M. Marberry



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Seattle, Wash., Smith Tower Bldg.

J. C. Peterson

C. E. Bennett

SEYMOUR W. GOERSS has become superintendent of production for Dominion Natural Gas Co., Brantford, Ont.; Republic Light, Heat & Power Co., and Penn-York Natural Gas Corp., both of Buffalo, N. Y. He will also continue to direct company geological development work.

The three top officers of Manufacturers Light & Heat Co., Pittsburgh, and its four affiliates, were elevated through a recent action of the board of directors. CHARLES E. BENNETT, president, became chairman of the board; JOHN C. PETERSON, vice president and general manager, became president; and FRED W. BATTEN, vice president and assistant general manager, became vice president and general manager.

F. W. Batten
Manufacturers

C. W. Scholvin
Schield

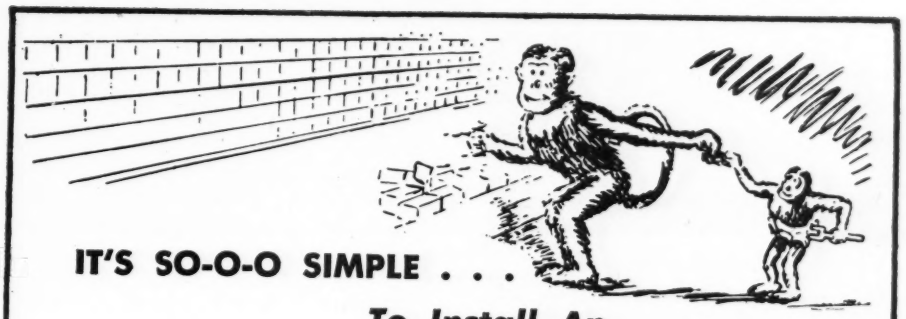
C. R. STANLEY has been named automotive engineer in charge of Pacific Gas & Electric's fleet of motor vehicles, succeeding SIDNEY B. SHAW who has retired after 40 years with the company.

New faces

New district manager for Schield Bantam Co. in a territory covering eastern Ohio, Pennsylvania, West Virginia, Virginia, and Maryland is C. W. SCHOLVIN. Mr. Scholvin has been associated with LaPlante-Choate Co. and R. G. LeTourneau Co. as district sales manager. He will headquarter in Harrisburg, Pa.

CAROL DOBRIKIN has been appointed home service director for the northern division of Southern Counties Gas Co., Los Angeles, succeeding MRS. ANN BERNSTEIN, who has left the company.

RAY M. EVANS, president of the Evans Lead Co., Charleston, W. Va., and WILLIAM



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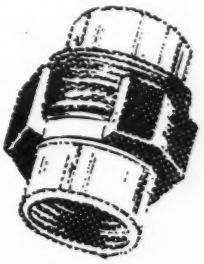

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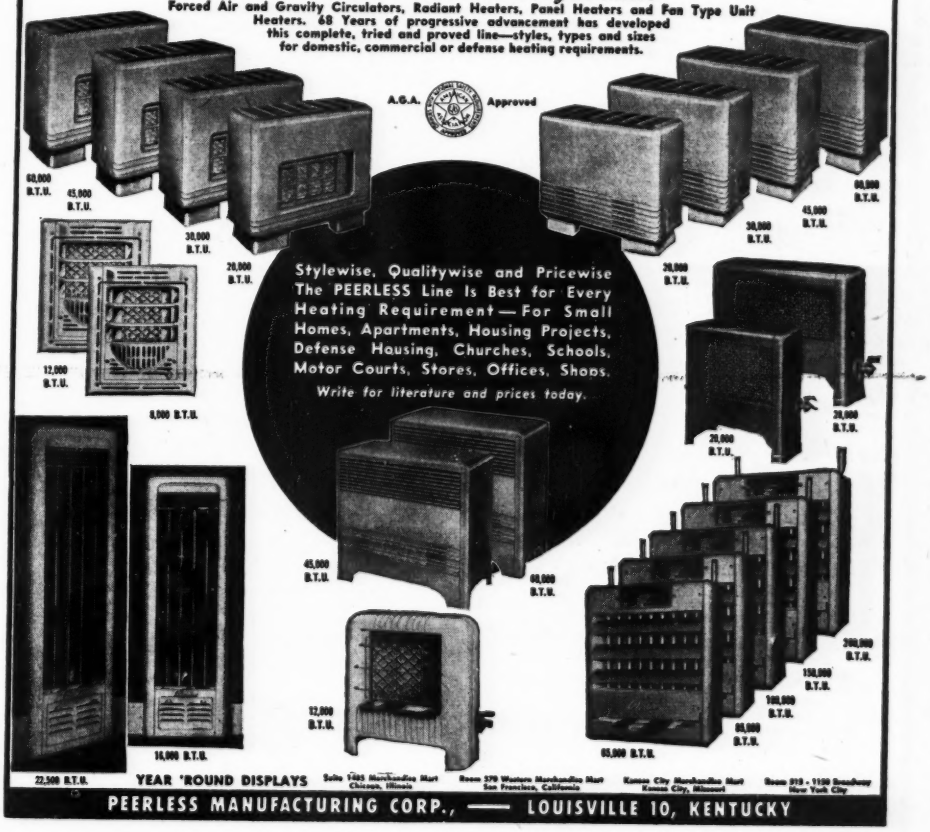

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B. ANDERSON, president of the Anderson-Newcomb Co., Huntington, W. Va., have been elected to the board of directors of the Columbia Gas System Inc.

CALDER B. CLAY has been elected a director of Atlanta (Ga.) Gas Light Co. He succeeds ERNEST D. BLACK, who died in September.

HOLLIS B. CHENERY, assistant professor in the department of economics, Stanford University, has been elected to the board of directors of Southern Natural Gas Co., Birmingham.

HARTZEL C. MILLS has been named Minnesota representative in St. Paul, for the Pittsburgh Lectrodryer Corp.

Deaths

CLARENCE L. LAW, 67, retired vice president of Consolidated Edison Co. of New York, died suddenly in December. When Mr. Law retired in 1950, after 43 years with the utility, he was in charge of the company's advertising, editorial, economic research, and industrial relations departments.

WILLIAM J. KELLEHER, 54, assistant supervisor of customer accounts for the Public Service Electric & Gas Co., Elizabeth, N. J., died last month. He had been with the utility for 29 years.

Honors

1953 officers of the American Chemical Society's division of gas and fuel chemistry include GEORGE D. CREELMAN, M. A. Hanna Co., chairman, succeeding DR. JOHN F. FOSTER, Battelle Memorial Institute; DR. CORLISS R. KINNEY, Pennsylvania State College, chairman-elect; and DR. HARLAN W. NELSON, Battelle, re-elected secretary-treasurer.

N. HENRY GELLERT, president of the Seattle Gas Co., has been re-elected a board member of the National Industrial Conference Board, an independent business and industrial fact-finding institution.

JAMES W. LEA, Atlanta Gas Light Co., has been elected co-chairman of the February Heart Fund drive of the Georgia Heart Assn.

RAY H. GLASSLEY, personnel director of the Portland (Ore.) Gas & Coke Co., has been appointed to the 13th regional Wage Stabilization Board by the national WSB committee.

CHARLES C. DRUMMOND, secretary and treasurer of Commonwealth Gas Corp., Richmond, has been elected a member of the Controllers Institute.

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Abstracts

IMPROVEMENT OF NICKEL CRACKING CATALYSTS—IGT Research Bulletin 20 by C. H. Riesz, H. A. Dirksen, and W. J. Pleticka.

The most significant findings reported are: (1) As a support material upon which the nickel is dispersed in active form, periclase (fused magnesium oxide) is as satisfactory as alumina (fused aluminum oxide); (2) Addition of small amounts (1.0 to 1.5%) of magnesium oxide or aluminum oxide as promoters greatly enhances the activity of stable but relatively low-activity catalysts; and (3) In a study of periclase supports with porosities ranging from 24 to 25%, activity was found to depend primarily on the quantity of deposited nickel per unit of catalyst volume; above a value of 4 lb of nickel per cu ft of catalyst, additional nickel impregnation had no further effect under the test conditions employed (1720-1740° F, 300 cf/cf cat-hr space velocity).

REMOVAL OF HYDROGEN SULFIDE AND CARBON DIOXIDE FROM SYNTHESIS GAS USING DI- AND TRIETHANOLAMINE—U. S. Bureau of Mines Report of Investigations 4891 by H. W. Wainwright, G. C. Egleson, C. M. Brock, J. Fisher, and A. E. Sands. This report, the first of a series on the operation of the purification pilot plant at Morgantown, W. Va., deals with the removal of hydrogen sulfide and carbon dioxide using aqueous solutions of di- and triethanolamine. Summary and conclusions follow:

The purification pilot plant and the equipment, solution, and gas cycle used for removing hydrogen sulfide and carbon dioxide are described.

As sulfur recovery is necessary in any large Fischer-Tropsch plant, pilot-plant runs were made at 300 psig to study the efficiency of triethanolamine solutions in removing selectively hydrogen sulfide from gases containing varying amounts of carbon dioxide.

Aqueous solutions of TEA of 20, 30, 35, and 50% were investigated. Data indicate that 30 to 35% is the optimum concentration if both selectivity and economy are considered. Slightly better selectivity is obtained with the 20% solution, but steam consumption is greater owing to the higher solution rates. Results from pilot plant runs indicate that a 50% solution not only produces an acid gas of lower hydrogen sulfide content but also requires high solution rates to effect hydrogen sulfide purification.

Data from 37 runs using TEA are presented in tabular form. In addition, the data are correlated and presented in three sets of curves. By using these curves, it is possible to calculate the compositions of the purified and acid gases for various raw gas mixtures.

In cooperation with the Southern Natural Gas Co., investigations were carried out at 300 psig on the simultaneous removal of hydrogen sulfide and carbon dioxide from

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gases using various concentrations of diethanolamine.

Data from 17 runs employing 20, 30, and 40% DEA are reported in both tabular and graphic form.

A comparison of the data from one DEA run made at 200 psig with those from the runs operating at 300 psig shows that the absorption capacity of the solution, and, hence, the steam requirements per gallon are about the same for both pressures. The only real advantage of the higher pressure is the additional volume of gas that can be treated.

The quantity of steam needed to reactivate fouled TEA and DEA solutions increased as the reactivator pressure was increased, about 1.0 to 1.1 lb of steam was required for each gallon of circulating solution when the reactivator was operated at 5 psig.

A curve is included that shows the effect of the hydrogen sulfide concentration in a lean 35% TEA solution on the hydrogen sulfide content of the purified gas and on steam consumption for reactivation.

Both TEA and DEA reduced the organic sulfur content of the raw synthesis gas considerably. Analyses of the lean amine solutions showed a gradual build-up of sulfur compounds, indicating that the compounds formed by the amines and organic sulfur do not break down under the ordinary operating conditions of the reactivator.

Results from one pilot-plant run in which 35% TEA was used and the absorber was operated at atmospheric pressure rather than 300 psig, showed that about 5.5 times as much steam for reactivation is required at the lower pressure in order to purify 1000 cu ft of raw gas.

A brief description of the analytical methods used during the pilot-plant operation is included in the report.

THERMODYNAMIC PROPERTIES OF NITROGEN—IGT Research Bulletin 18 by O. T. Bloomer and K. N. Rao. The engineering design of plants to separate nitrogen from natural gas requires accurate data on the thermodynamic properties of nitrogen over a wide range of conditions. Previously published charts either cover an inadequate range of pressure or suffer from scale modulus limitations. To provide charts of value to the natural gas industry, researchers at the Institute of Gas Technology have recalculated the usual thermodynamic properties of nitrogen on the basis of more recent fundamental data from the published literature.

This bulletin presents the properties in tabular form and as charts of enthalpy vs. entropy, and of compressibility factor as a function of temperature and pressure. The range of the tables and charts is from saturated liquid at −320.4° F to superheated vapor at 500° F, and pressures from 10 to 1500 psia. Properties tabulated are specific volume, enthalpy, entropy, and the fugacity-to-pressure ratio. For the superheated vapor region, calculations were based on zero-pressure specific heat data and a new equation of state.

ASSOCIATIONS

AGA's executive committee appointed for 1953 term

Nine officers and directors have been named to the new executive committee of the AGA to aid in conducting the affairs of the association for the coming year. The committee, with the same authority as that vested in the board of directors, functions during the intervals between meetings of the full board.

Members appointed are: Frank C. Smith, Houston (Texas) Natural Gas Corp. and AGA president; Earl H. Eacker, Boston (Mass.) Consolidated Gas Co.; F. M. Banks, Southern California Gas Co., Los Angeles; Edward F. Barrett, Long Island Lighting Co., Mineola, N. Y.; Charles E. Bennett, Manufacturers Light & Heat Co., Pittsburgh; Lyle C. Harvey, Affiliated Gas Equipment Inc., Cleveland; J. F. Merriam, Northern Natural Gas Co., Omaha; Dean H. Mitchell, Northern Indiana Public Service Co., Hammond; and J. Theodore Wolfe, Consolidated Gas Electric Light & Power Co. of Baltimore.

First PR conference held by New England Gas Assn.

The New England Gas Assn. held its first public relations conference in Boston last month. Executives of four different utilities gave their views on the approach to public relations and outlined their respective companies' practices and methods.

Among the speakers were Robert M. Brigham, Springfield (Mass.) Gas Light Co.; Alfred M. Wade, Connecticut Light & Power Co., Willimantic; Horton Chandler, NEGEA Service Corp., Cambridge; and E. G. Twohey, New England Electric System, Malden, Mass.

Measurement short course to be expanded this year

Expansion in the number of subjects to give wider coverage will be a feature of the Southwestern Gas Measurement short course, scheduled for the University of Oklahoma, Norman, April 21-23, according to T. S. Whitis, West Texas Gas Co., chairman of the general committee.

As in former years, sessions will be held under the sponsorship of the college of engineering; the Oklahoma Utilities Assn. will be an assisting sponsor.

Oklahoma utility group elects Wolfe president

W. R. Wolfe, Oklahoma Gas & Electric Co., Oklahoma City, has been elected president of the Oklahoma Utilities Assn. for 1953, succeeding Richard W. Camp, Consolidated Gas Utilities Corp., also of Oklahoma City. Other officers are Earl J. Newlin, State Fuel Supply Co., vice president; Harry P. Pitzer, Chickasha, 2nd vice president; H. H. Ferrin, Oklahoma City, vice president and treasurer; Kate Niblack, secretary; and Thelma T. Jones, assistant secretary.

The annual convention of the association will be held at Hotel Tulsa, Tulsa, March 26-27.

PCGA cooperates with ASME in Western Metal Congress

The Pacific Coast Gas Assn. is among the 19 organizations cooperating with the American Society for Metals in the Western Metal Congress and Exposition to be held in the Hotel Statler and Pan-Pacific auditorium, respectively, in Los Angeles, March 23-27.

New developments in high-heat processing of ferrous and non-ferrous metals will be featured and high-speed furnaces, case and homogeneous carburizing equipment, air-gas proportional mixer equipment, blast burners and pressure gauges will be on display.

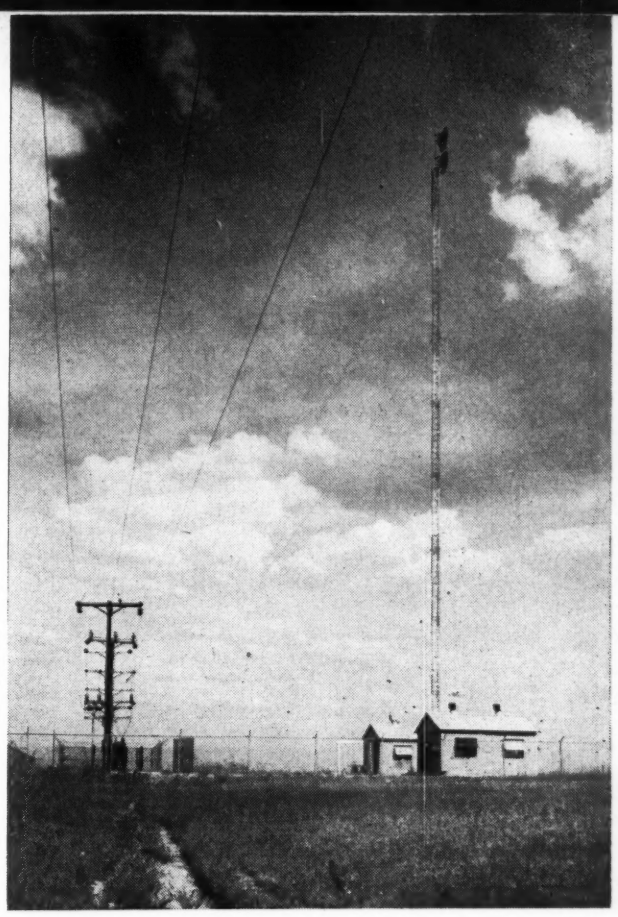
Association notes

The seventh regional branch office, to be known as the east central district office, has been established by the Liquefied Petroleum Gas Assn. at Harrisburg, Pa. Headquarters were opened the first of this month with William H. Plank in charge as district secretary. The new district will serve the states of Pennsylvania, New York, New Jersey, Maryland, Delaware, Virginia, and West Virginia.

Everett N. McDonnell, president of McDonnell & Miller Inc., Chicago, received the 1952 F. Paul Anderson Medal of the American Society of Heating and Ventilating Engineers at the society's 59th annual meeting in Chicago on Jan. 28. The award, presented by Ernest Szekely, ASHVE president, was "for outstanding work in the field of heating, ventilating and air conditioning."

A five-day course on "Fundamentals of Industrial Safety" will open the 1953 session of the National Safety Council's safety training institute to be held Feb. 16-20 in Chicago. This basic course, designed to help those engaged in industrial accident prevention work gain a better understanding of occupational safety principles and methods, will be offered, in addition, on March 9-13, May 11-15, June 8-12, Nov. 9-13, and Dec. 7-11.

The annual convention of the Desk and Derrick Clubs of North America will be held in Denver, Sept. 10-11, according to Miss Margaret Neff, president of the association. Miss Minetta Miller, Sioux Oil Co., Denver, has been appointed general arrangements chairman.



General view of the remote booster station showing the antenna tower, the control building, and the building housing the pumping unit. (Fig. 2).

A booster station microwave system

BY J. R. ELLIS • Sunray Oil Corp., Tulsa

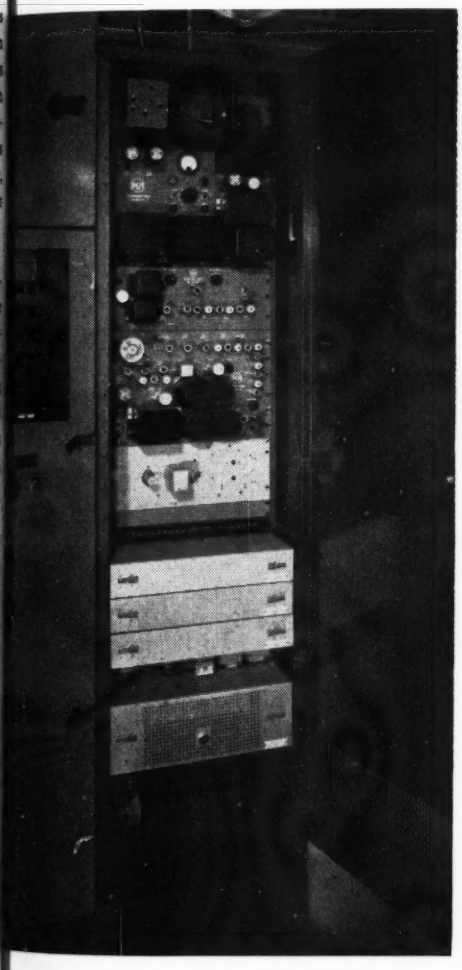


Fig. 1. Microwave radio and channel equipment required at the station.

IT recently became necessary for my company to increase the capacity of an 8-in. 85-mile-long products pipeline by the installation of an intermediate booster station at a point on the line approximately 32 miles from the initial pump station.

The booster station, which was placed in operation the first of last year, takes advantage of recent developments in automatic controls and communication devices that have been made available to industry. The use of these devices makes it possible for the station operators on duty at the initial pump station to observe operating conditions at the remote booster station. These observations permit regulation of the pumping rates in a manner that insures operation of the pipeline at maximum throughput by the utilization to best advantage of the power available at both the initial and booster stations. The remote station may be stopped and started from the initial station as required.

A microwave radio system provides the communication channels for the supervisory controls and for the telemetering equipment, which makes the remote operation possible. Radio was chosen for this service for several reasons—one being that it could be installed at a cost one-third less than that required to provide a wire-line circuit between the stations. Installed cost of the radio circuit was approximately $600 per physical mile. Circuit availability and maintenance cost were also prime considerations.

The microwave radio system operates in the 940- to 960-megacycle frequency band, which is a comparatively low-frequency insofar as microwave is concerned. Some people in the radio field are reluctant to consider such a low frequency to be true microwave as the wavelength is approximately 1 ft as compared to the actual microscopic length of extremely high frequencies. This frequency band was selected because of the reliable and simple radio circuits employed. Also, the standard type radio tubes used for these frequencies have a better record for long service life than some of the special types required by the higher frequencies. The propagation characteristics of the selected frequency are such that there appears to be less fading and loss of communications caused by varying atmospheric conditions than are experienced when higher frequencies are used. The 940- to 960-megacycle microwave frequency band offers one of the best means of communication for point-to-point service over distances up to 300 miles. It provides for simultaneous operation of

Adapted from a talk given at the annual meeting of the American Petroleum Institute.

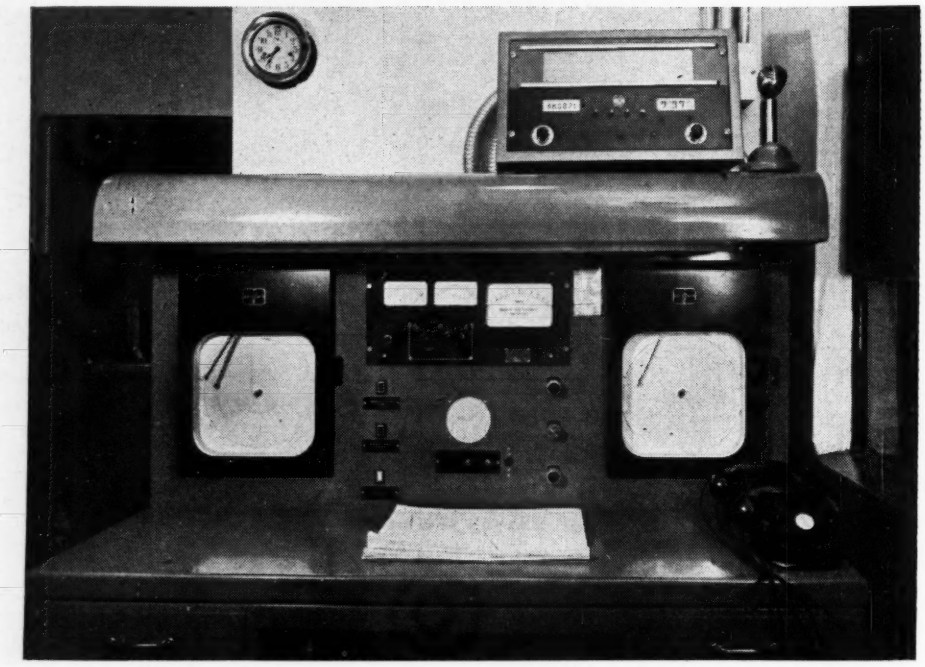


Fig. 3. Control console at the initial pump station controls the remote station. Both local and remote station operation may be observed simultaneously.

up to six voice channels. From 9 to 18 telemetering, remote-control, or supervisory circuits may be substituted for each voice channel; and this is accomplished by utilization of the single-sideband suppressed-carrier type of multiplex apparatus, similar to standard telephone carrier equipment.

Fig. 1 shows all of the microwave radio and channeling equipment required at the remote station. This equipment provides a two-way voice channel to the control console at the initial station, and receives and transmits the tone signals that operate the various supervisory and telemetering equipment.

Power output

The power output of the microwave radio transmitter is two watts. This small amount of radio energy is conducted to the antenna through a gas-filled coaxial cable. The antennas consist of small dipoles, with parabolic reflectors 6 ft in diameter, which concentrate and focus the radio waves in the same manner that a beam of light is focused, so that a maximum amount of the energy radiated is directed toward the receiving antenna. Two antennas are required at each location—one for transmitting and one for receiving. These are mounted on steel towers 170 ft high at both the remote and the control stations. The tower height provides the necessary line-of-sight path between the stations without requiring an intermediate relay station.

Fig. 2 is a general view of the remote station. It shows the antenna tower, which is located between the control building and the building which houses the pumping unit.

The remote station is controlled from the console shown in *Fig. 3*. The console is located in the office of the initial pump station in such a position that the station operator may observe operating conditions at both the local and the remote stations. The panel of the console is equipped with recording instruments that give a continuous record of the suction and discharge pressures, as well as the kilowatt-hours of power being used at the remote station. Signal lights give a visual indication of operating conditions, and a horn is sounded in the event the remote station goes off the line because of power failure or other cause.

Starting the station

To start the remote station, the operator observes the reading of the discharge-pressure recorder, which shows the line bypass pressure at the remote station when the latter is shut down, as well as the remote-station discharge pressure when the station is operating. The operator then adjusts the pumping rate to obtain the optimum bypass pressure for starting at the remote station. Pressing the start button transmits a tone signal via the radio, which closes a relay at the remote station, thus instituting the starting sequence.

When the start impulse is received at the remote station in the form of a tone

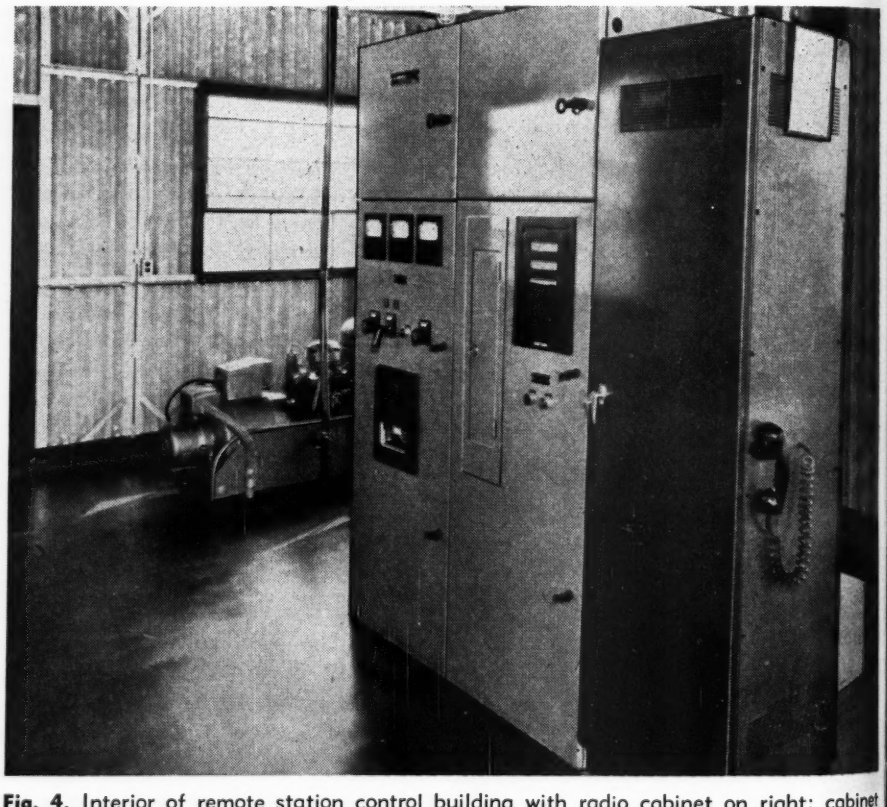


Fig. 4. Interior of remote station control building with radio cabinet on right; cabinet housing all relays and switches and starting equipment at left; standby electric-power generator is in background.

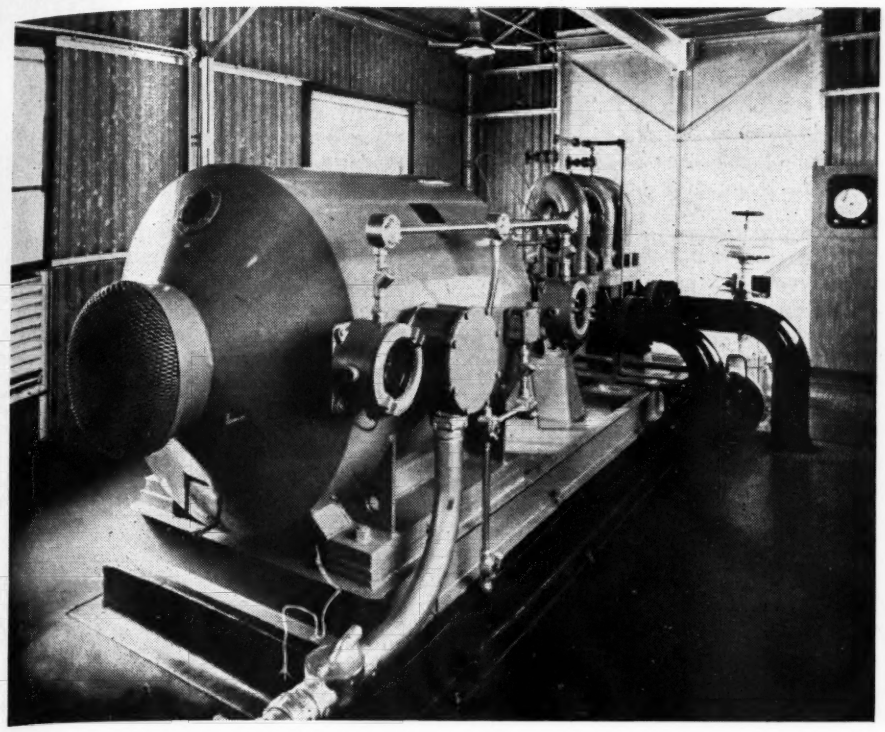


Fig. 5. Remote-controlled station pump room showing pneumatically operated pump discharge motor valve and controller in the background.

signal from the radio receiver, it operates a relay which, in turn, closes a contactor, which causes a valve located in the station manifold to open, and this permits fluid to enter the main pumping unit. When this manifold suction valve reaches a full open position, contact is made causing the main pump motor to start. When the pump reaches normal operating speed, the manifold discharge valve opens and the station is on the line, subject to the operation of certain automatic pressure control. This will be discussed later. The failure of any of the equipment to operate properly, or the loss of suction pressure during the starting sequence, automatically will cause the controls to return the station to standby condition. All controls are designed for fail-safe operation.

Starting cycle

It requires about two minutes to complete the starting cycle. By observing the chart readings, the operator is able to increase the pumping rate at the initial station in order to utilize fully the extra line capacity as it becomes available by reason of the remote station's coming on the line. Pressing the stop button reverses the starting sequence and isolates the booster station from the line in standby condition. The stop-and-start buttons are the only manually operated controls on the console.

Fig. 4 is an interior view of the remote-station control building. The radio cabinet is on the right. The cabinet on the left houses all of the relays and switches which provide for the sequence operation, as well as the 2300-volt starting equipment for the main motor. In the background is the standby electric-power generator. In the event of a power-line outage, enough power is available to close the manifold valves, which isolate the station from the pipeline, and to maintain radio communication until regular power is restored. Operation of the standby generator is indicated at the control console by a signal light.

Pumping unit

The booster station has a single pumping unit consisting of a 700-hp explosion proof electric motor, which drives a 6-stage centrifugal pump. The pump is rated at 35,000 bbl per day at a differential pressure of 900 psi when gasoline is being pumped. The motor and pump are provided with shutdown controls so that the various component parts will be protected against overheating. The pump is equipped with single mechanical seals, and protection against seal failure is obtained by a float switch that will shut the unit down when an excessive amount of fluid drains to the sump. A combustible-gas analyzer for the continuous sampling of the atmosphere in the pump room is being installed to shut down the station in the event an explosive mixture should develop. This equipment is considered necessary to provide a means of detecting small leaks that might develop in the pump room. These small leaks, although not of sufficient magnitude to result in a pressure drop, could result in the creation of a hazard or the loss of a considerable amount of product over an extended period of time. The operation of any of these protective devices sounds the alarm at the control console, and drops a flag on an annunciator panel at the remote station. Correction of the trouble and manual reset are required before the remote station can again be started if any of the annunciator flags are dropped.

The pump room

Fig. 5 is an interior view of the pump room. The pneumatically operated pump-discharge motor valve and controller may be seen in the background. Of particular interest is the dual-pen single-pilot pressure controller, which has a single pilot that may be actuated by either the suction- or discharge-pump pressures. This instrument, shown in *Fig. 6*, controls the motor valve on the pump discharge. A timing device permits the pump to start and come up to normal operating speed with the motor valve closed. This discharge-set pointer is then slowly advanced from its initial setting, which is equal to the adjusted station bypass pressure of about 400 psi at the time of start-up, to the operating pressure-set point, which is not allowed to exceed 1050 psi. The timing device consists of a small electric-clock motor installed in the upper left-hand portion of the instrument case. This device starts when the electrically operated discharge valve in the station manifold clears its port. The clock motor, through a system of cams and levers, advances the discharge-set pointer over a timed interval from 5 minutes to 15 minutes. This permits the pump to come on the line by a gradual opening of the discharge motor valve without overloading the motor that drives the pump, and without overpressuring the pipeline during the time that the high pump-case pressure, caused by the high suction pressure at the time of starting, is being lowered.

After the pump is on the line, the pressure controller provides throttling action, as required, to maintain preset suction and discharge pressures. An arrangement is made to return the discharge-set pointer to the starting posi-

tion when the station is shut down. The pump-discharge motor valve is of the air-to-open type, and is held in the closed position during shutdown periods by a solenoid valve in the instrument air-supply line. The position of the solenoid valve always coincides with the position of the manifold discharge valve. Pressure switches are installed on the pump-suction and station-discharge lines, and operate to shut the station down if safe operating limits are exceeded. The suction switch also provides a means of shutting the station down in the event of an emergency that might arise during a period when communication between the stations had been lost. Emergency shutdown is accomplished by overriding the pneumatic controller and reducing flow through the pipeline to a point at which the pump-suction pressure will fall below a preset minimum pressure of 10 psi.

Telemetering units

Standard telemetering units collect the data concerning pressures and power consumption at the remote station and furnish timed impulses that key the respective tone units in the radio cabinet. These tones are transmitted to the receiving units at the initial station. The length of the signals received during each 15-second interval is proportional to the full-scale reading of the instruments. This results in the transmitted data being recorded accurately on the control console instruments.

The wattmeter, which transmits the power consumption, is located in the door of the main starter cabinet and the suction- and discharge-pressure transmitters are located in explosion proof enclosures adjacent to the pump building.

In addition to the station just described, two other remotely controlled booster stations are being operated on a 6-in. pipeline, which now has a total of four stations spaced over its length. The two booster stations are controlled from an intermediate pump station by its regular complement of station operators. By reason of the radio-transmitted information available to the operator at all times, the operation of all the stations can be synchronized in a manner that maintains the maximum throughput of the pipeline.

The operation and control of the booster stations are essentially the same as the system employed on the 8-in. pipeline. The principal difference is that a hydraulically operated pump-discharge control valve is used rather than the pneumatic controls previously described. This method makes use of hydraulic pilots for suction- and discharge-pump pressure control. A timing device, which consists of an accumulator and a variable orifice, accomplishes the same throttling action as the dual-pen controller when the stations are being started.

Many unforeseen difficulties developed during initial operation of the stations. One of the most serious was caused by dust accumulations in the many relays in both the tone units and sequence controls. This problem will be completely eliminated in the future by the installation of a small blower to pressurize the control and radio cabinets with a supply of filtered air. This problem emphasizes the need for using dust-proof equipment under the adverse conditions often encountered in the field.

The remote booster station is designed for normally unattended operation, and could operate for an extended period of time without attendance. However, a policy has been established that provides for one man to be on duty 40 hours per week to maintain the station equipment and grounds. This attendance exceeds the minimum requirement, but because of the distance that separates the remote station from other installations, it is not economical to provide the transportation that would be required for lesser attendance. The station normally operates for periods of 72 hours without attendance. The operation and control of the remote station do not require additional personnel at the initial station.

Selection justified

Experience indicates that the selection of microwave has been justified, as maintenance cost has been low and circuit availability has been approximately 98%. This service factor is excellent in view of the fact that standby radio equipment is not provided and the time out of service includes the total outage from all causes—including tube failures and control-equipment faults. Efficiency is constantly improving as a preventive-maintenance routine is developed. Maintenance of the microwave equipment requires only a small portion of an electrician's time, and does not interfere with the performance of his other duties. The additional equipment required to permit operation of the station by remote control is estimated to have increased the total station cost 15% over what it would have been if manual controls requiring full attendance had been installed. Savings in labor cost alone have paid out this additional investment in nine months of operation.

The use of microwave as a means of remote-station control has proved satisfactory in this instance, and has made possible a considerable increase in the capacity of the pipeline with a minimum increase in operating costs.

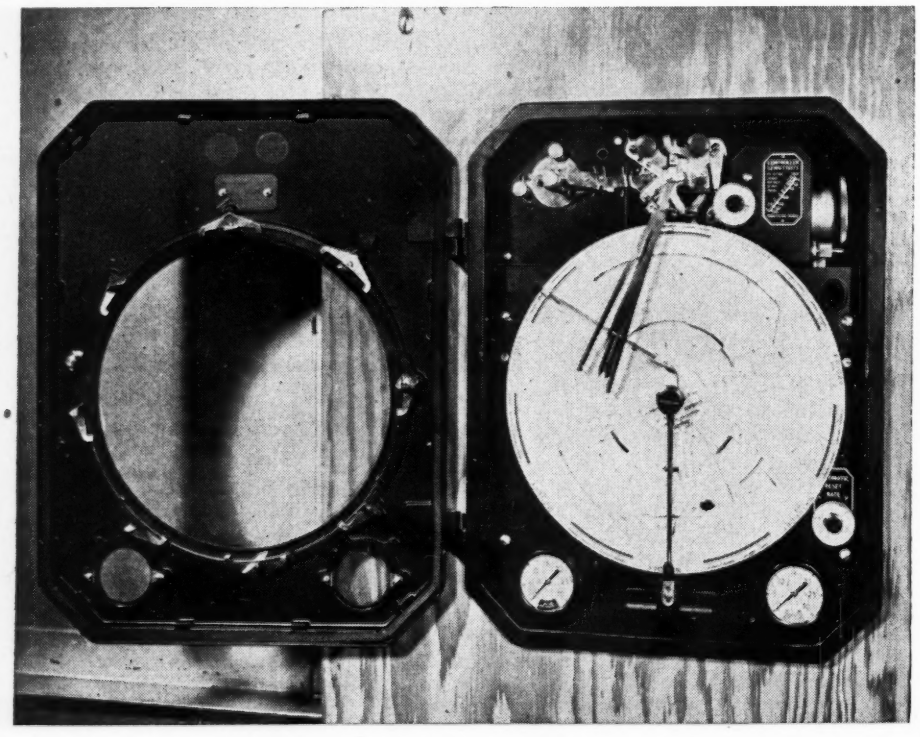


Fig. 6. Pump suction and discharge pressure controller for regulating the motor valve on the pump discharge.

Developing specifications for coal tar pipeline coatings

By N. T. SHIDELER • Pittsburgh (Pa.) Coke & Chemical Co.

ALMOST without exception, coatings for pipelines have been purchased by name of product without reference to a specification and without even checking to see that the coating conforms to the manufacturer's specification. In spite of the fact that users have laboratories available, rarely have coatings been checked unless troubles develop in the field during application or after a failure in service.

Consequently, manufacturers have not attempted to supply coatings to fit individual requirements, coatings with the same chemical and corrosion resistance but with widely different physical characteristics.

There is a definite need for cooperation between the manufacturer and the user so that adequate specifications can be written, limiting the characteristics of the coatings to conform to particular performance requirements. The consumer points out the performance and together they write the specification covering the coating that most nearly fits the job requirements.

Performance testing is of necessity long, time consuming, tedious and exasperating. No tests are available today that even remotely approach the results obtained by actual application of coatings to sections of pipelines and carefully watching over them for a period of several years. Even in the field application, the condition is not the same in any two localities. Perhaps a tabulation of some of the pertinent points of performance would be of help.

1. Soil stress resistance.
2. Pressure stresses or deformation by pressure of stones, heavy objects and weight of pipe.
3. Solubility in crude petroleum and petroleum products.
4. Solubility in water.
5. Moisture absorption in coating.
6. Acid and alkali resistance
7. Electrical resistance under service conditions.
8. Soil and pressure stress resistances at various field pipe temperatures.
9. Resistance to cracking at low temperatures and hardness of coating at outside atmospheric summer temperatures.
10. Response of coating to application conditions, ease of application and handling.

We should consider these various points to see how near we have come in developing performance methods of testing.

1. We are all acquainted with the field tests run by the Bureau of Standards and the AGA a few years ago and the conflicting results obtained. Now we have the Mudd-Sheppard coupon test, which is receiving some prominence. This latter test method is conducted in soil in tanks above ground and at Houston atmospheric temperatures. As a result, the temperature of the soil in which the coupons are tested must at times reach 80 to 90° F or higher. Such temperatures do not take into consideration the characteristics of the enamels or their recommended uses. For instance, the wide-range enamel is extremely soft at a temperature of 90° F and would have little resistance to the soil stress that would be exerted on the coating by the soil in these tests. The wide-range enamel is recommended for cold weather application and for pipe that may be subjected to low ground temperatures. It is not expected to be subjected to such conditions at such temperatures. The use of the magnesium coupon is also very questionable.

Mr. Shideler's work is in the research and development of various protective coatings. With Pittsburgh Coke since 1948, he is at present engaged in the development and servicing of coal tar base coating.

A very simple shear test is being tried, consisting of two steel plates ¼ x 2½ x 4 in. with a ¼-in. hole in one end of each plate. The plates are primed on one face then placed on a template that holds the plate ¼ in. apart, the hole in one plate at one end of the template and the hole in the other plate at the opposite end. The enamel being tested is poured between the plates at normal application temperature. After cooling, the excess enamel is cut off with a hot knife and the plates removed from the template; thus, the plates are bonded together by a strip of enamel ¼ in. thick, 2½ in. wide and 2½ in. long. The plates are then suspended on a vertical surface and a 20-lb weight is hung on the outer plate. The amount of shear movement is measured from the end of one plate. Tests have only been in progress a short time, but two points have been quite evident: The test is quite a good test for determining the bonding strength of the primer, and the rate of movement with the various coatings is dependent upon the temperature at which the test is conducted and the nature of the coating. It is quite possible that it may have a direct relationship to the stresses exerted by the soils.

2, 8. Pressure stresses are being measured in a few laboratories by measuring the penetration of weighted flat and round surfaces resting on the coating surface. The test weights range from 10 to 100 lb with the tests run at constant temperature. As in the shear test described above, the temperature at which the test is conducted governs the results. It is believed that these tests conducted at maximum and minimum underground pipeline temperatures may be quite indicative. In 1951 Corfield and Shupp*

*"Long-Time Performance of Pipeline Coatings." Guy Corfield and C. W. Shupp. *GAS*, September 1951.

Standard set-up for determining resistance of the coating to penetration by a sharp object, according to the ASTM method.

introduced a somewhat new method of testing pressure stress.

3. Solubility in crude petroleum and petroleum products is important to the oil people and to a certain extent to the gas people in so far as their lines may pass through petroleum contaminated soils or be adjacent to or cross oil lines. Fairly good indicative results can be obtained in the laboratory by immersion tests as reported by Carl Miller.[1]

4, 5. Water solubility and moisture absorption of the coal tar coatings can almost be forgotten for the manufacturers have tests that have been conducted for as long as 10 years under water with not more than 0.2% moisture absorption being noted and no water solubility.

There are steel water lines in service today that were lined with the coal tar enamel as early as 1914. These coatings are still in excellent condition and show no more water absorption than given above even after all these years of continued immersion. The only point that might upset the moisture absorption would be the use of a water-soluble filler. This could easily be checked by determining the ash content of the coating and running solubility of the ash. Moisture absorption on other coatings, however, is not so consistent for we are all probably familiar with coatings that in moist soils may be perfect for as much as two years and then gradually absorb moisture, become spongy, lose bond, and permit corrosion. So far, there is no method available to determine such characteristics in reasonable time intervals.

6. Acid and alkali resistance can be determined in the laboratory by simple immersion tests that are quite reliable.

7. Electrical resistance under service conditions is not run as a performance test. It should not be too difficult to devise one but this is not too important with the coal tars because of their normal high dielectric strength. If the Jeep-active carbon is present it is immediately detected by the spark or holiday test.

9. Resistance to cracking at low temperatures is a standard specification test and quite reliable.

10. Response of the coating to application conditions is easily determined in handling the coating in the laboratory.

The performances mentioned above are not pointed out to start everyone off on a long series of complicated performance testing on coatings, but to focus attention on certain points because the consumer should consider these things when specifying and purchasing the coatings, then make sure that the coating meets the specification.

Of prime importance to the corrosion engineer is the selection and specification of the coating that will give the best service when the following determinants are considered:

1. Atmospheric temperatures that will prevail during application of the coating and installation of the pipeline.
2. What will be the minimum and the maximum "in service" pipe temperature?
3. Type of soils through which the pipe is to be laid. The importance of the specification in relation to these points will be shown later.

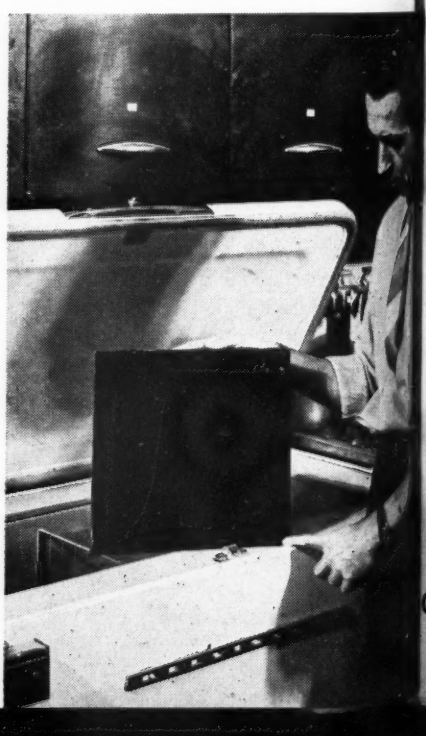
Everyone is aware of the effect of the atmospheric temperatures prevailing at the time of application. If the weather is to be extremely hot then it is not wise to use the wide-range[2] enamel because of its slowness in setting up, its softness at elevated temperatures and the difficulties of handling the pipe with a soft coating. The moderate and narrow-range enamels handle much better under such conditions, provided they are held within the specification.

The minimum and maximum in-service pipe temperature is one point that has been neglected but is of extreme importance. On oil lines, the pipeline temperature is just about the same as the soil surrounding the pipe. However, frequently on gas lines the gas is not cooled too much as it leaves the pumping station, and with the constant flow of a large volume of warm gas the pipe temperature may be high for almost all the line between pumping stations. Consider the softness of the three grades of enamels at different temperatures and it is easily seen that proper selection is important. For instance, the wide-range enamel is so soft at 115° F that it can be molded between the fingers; at 77° F it is still quite soft and does not present a real firm surface until the temperature is about 50° F. With this enamel on a line that is predominantly at temperatures above 70° F and where the soil surrounding the pipe may contain stones or anything other than smooth loose soil, the electrical resistance of the line would be expected to drop rapidly in service owing to puncture of the coating by stones and foreign bodies in the soil, or to be greatly affected by soil stress. The moderate-range enamel, although as soft or almost as soft as the wide-range coating at 115° F, is quite firm at 77° F and at about 60° F is just about as firm as the narrow-range coating. The narrow-range coating, although harder than the other two, is more subject to cold flow.

When the three points are considered together, it is quite apparent that for the present products on the market sacrifices must be made, for the coatings are not perfect. However, it is a personal feeling that changes can be made that will correct some of the sacrifices.

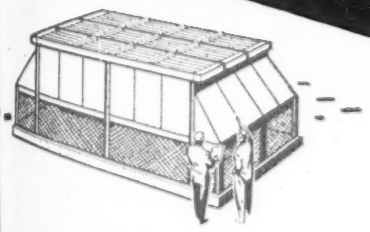
The wide-range specifications[2] of the three-range products given in *Table 1* are familiar and, as stated in the article, the

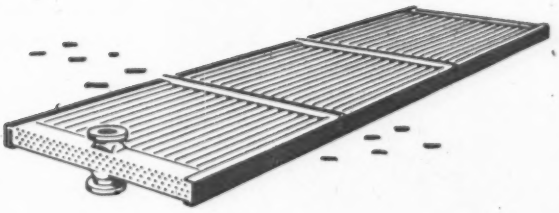
This plate has just been removed from the cold test box. The cold-cracking lines are quite distinct.



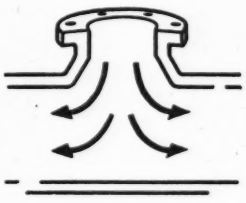
[1] "Effect of Spillage on Hot Applied Coal Tar Coatings." Carl Miller, *Oil & Gas Journal*, March 17, 1952.

[2] "Hot Applied Coal Tar Coatings." N. T. Shideler, *Petroleum Engineer*, March and April 1950.



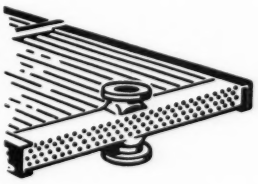


Transaire Sections offer these advantages:



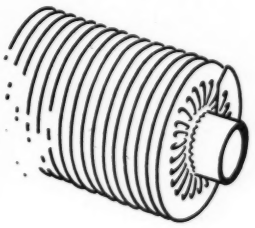
1. Less pressure drop

Inlet and outlet nozzles in the header-manifold allow for a full pipe cross sectional area opening into the header with curved entrance to keep velocity pressure loss at a minimum. Note how the nozzle widens out below the inlet flange permitting a smoother, more natural flow into the header. Tube holes are taper countersunk for the same reason.



2. Four-to-one safety factor

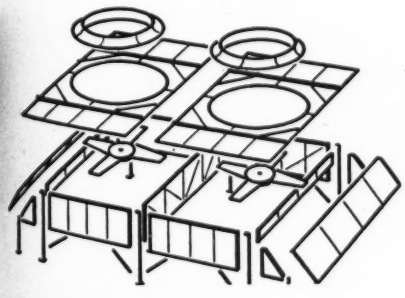
Headers are either cast iron or fabricated steel and in either case are *unconditionally guaranteed* to withstand test pressures of four times the design pressure. Brass header plugs provide quick easy access to tube ends for cleaning or replacement without requiring special tools.



3. More heat transfer surface

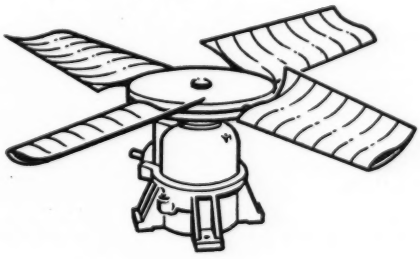
Fins are crimped, and crimped fins present more surface area to tubes which in turn means more metal-to-metal contact and greater dissipation of heat. The crimp also presents more fin surface to passing air. Tubes are available either in admiralty, steel or other materials as required. Fins of copper or aluminum.

Fluor Structures provide these advantages:



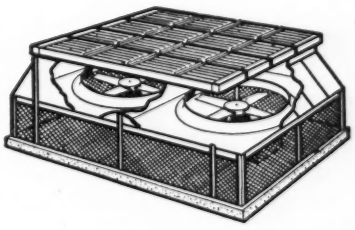
1. Rigidity of steel

The entire steel structure is conservatively designed with "truss-type" construction. All parts are prefabricated to size to fit all units which greatly facilitates field erection work. Fluor's wide experience as designers and constructors of plants and equipment for industry insures proper application and successful operation of every Fin-Fan installation.



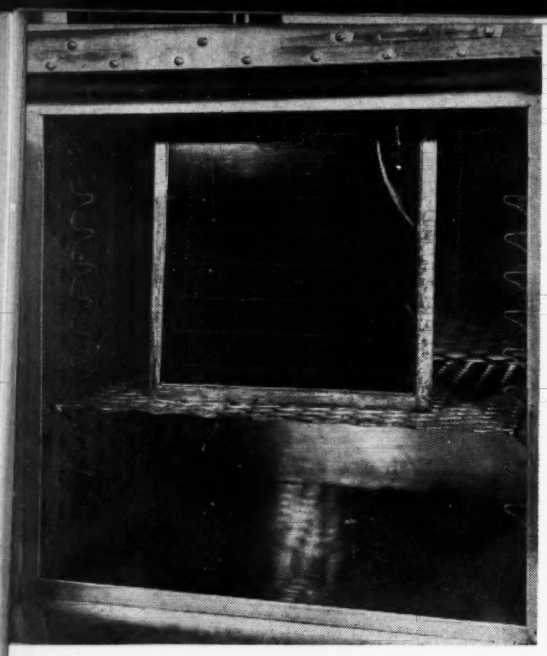
2. Mechanical excellence

Mechanical equipment for Fluor Fin-Fans is built to withstand the most rigorous heat transfer requirements. 4 basic gear units cover 4 different and distinct horsepower ranges. This, coupled with a choice of fan assemblies ranging up to 20′ diameter with 2, 3, 4 or 6 blades per fan unit, enables the proper combination of gears and fans for maximum efficiency.



3. Meet space requirements

Fluor Fin-Fans are adaptable to available space. They may be connected in series for long temperature ranges, or in parallel for large capacities. Single units can be used for multiple duties in widely diversified applications economically and at low maintenance costs. Parts are simple and standardized to save erection time in the field.



Test plate in oven used to determine the sag of the coating at high temperatures. White streak is caused by a flaw in pouring the enamel.

specifications are necessarily wide in order to include all manufactured products. Because of the broadness of the specifications, it would not be reasonable to use any one of these specifications to specify a specific coating for a specific job.

It is needless to say that even the broad specification in *Table 1* does not cover the ranges sometimes supplied for coating.

Now consider specific specifications, narrow enough to insure uniformity in the field and yet broad enough to enable the manufacturer to manufacture the product within specification without undue care or without increasing the cost *(Table 2)*.

The tests outlined in *Table 2* are the essential ones for the control of the product by the manufacturer and by the user. Even then, the routine tests that the manufacturer must run on every batch of material are only three, the softening point, ash and penetration. As long as the method of manufacture or sources of raw materials are not changed, the other points remain constant. From the user's standpoint, he should run all tests at least on random samples and should always check the three points that the manufacturer must run.

It is worth while to cover the points of the specification, their meaning and importance. The specific gravity gives the coverage to be expected from the product; in another sense, it tells whether a coating is adulterated with petroleum products. Thus, except for adulteration, it has no significance in the quality or the performance of the product. Softening point is very important, for softening point in conjunction with penetration and ash determines the performance of the product. This goes only in one direction; if a coating is off specification, it is better to have the softening point go higher rather than lower. Lower softening point usually means that the cold flow characteristics are increased. Softening point gives a fairly good guide to the application temperature of the coating. Ash or mineral filler is important because too little will yield a brittle product, while too much renders the coating too viscous at application temperature. Filler content also affects the softening point; the higher the filler content the lower the softening point required for the pitch from which the coating is produced.

Penetration is all important when considered with the softening point of the moderate and wide-range enamels. The ratio of the two penetrations in conjunction with the softening point somewhat controls the sag test temperature and the cold cracking temperature of the coating. To the consumer it is of interest because it gives him concrete evidence regarding the amount of change in softness of the product with change in temperature. How important this is will be shown later.

Sag test is not so important in pipeline work because the coating is nearly always in conjunction with a wrapper of some sort, which prevents flow or slide of the coating from the pipe at higher temperatures. However, it is a partial measure of the cold flow of the product.

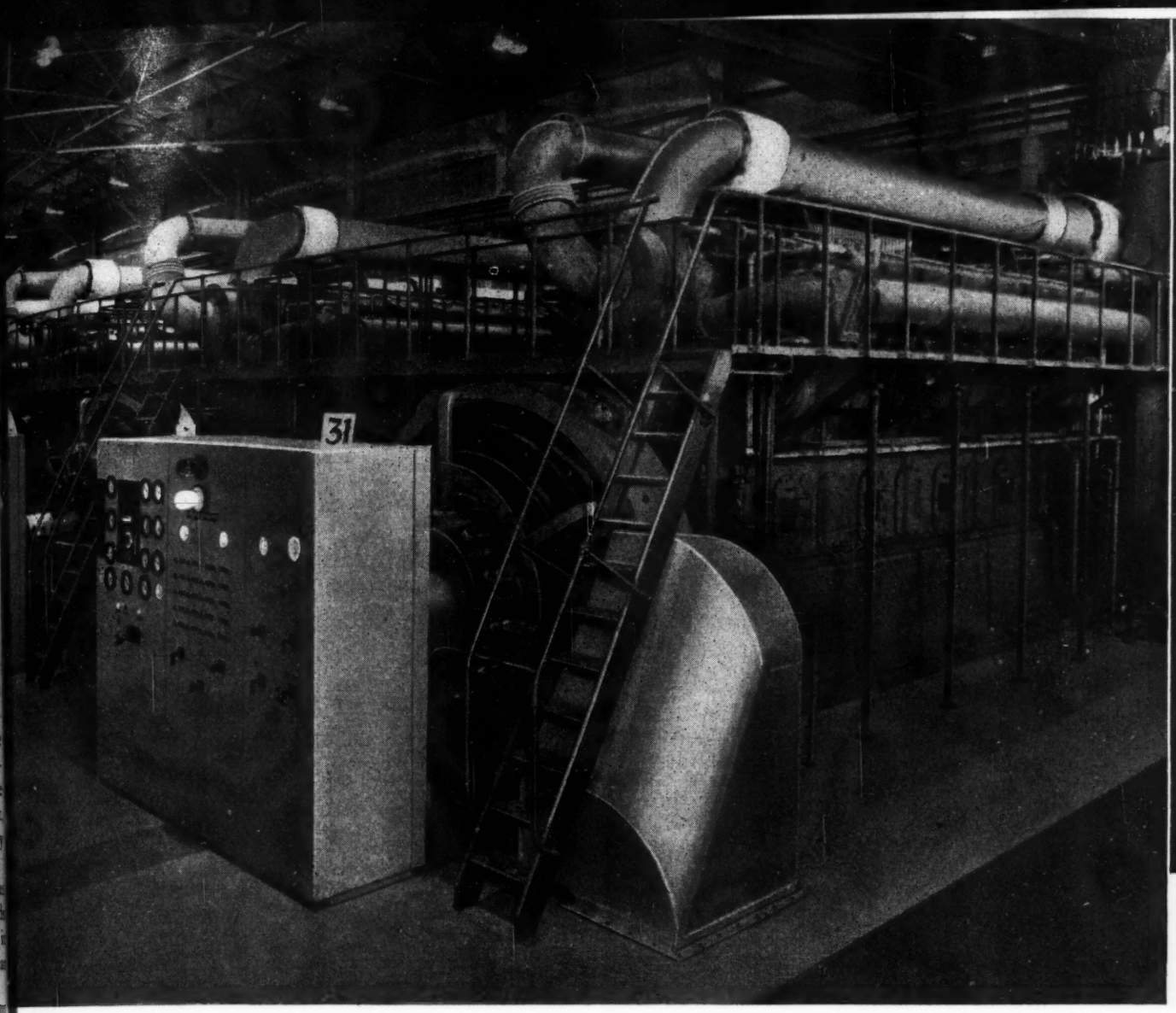
Cold test, or cold cracking temperature is mainly important during the application of the coating and installation of the pipe. Once under ground, the pipe is rarely subjected to temperatures below freezing. Above ground, the pipe is subjected to atmospheric temperatures that may be quite low or high.

Stripping test is a measure of the bonding qualities of the primer. Without proper bond the coating cannot function properly. The shear test described earlier brought out a fault in one of the primers that the stripping test did not show. In the particular instance, the primer passed all stripping tests, but when used with its enamel in the shear test permitted the enamel to slide on the primer and was quite evident from merely a visual observation. Interesting in this test was the point that if the bonded plates were allowed to remain at room temperature several weeks and then subjected to test the primer was apparently absorbed by the enamel and there was no slippage.

The use of the holiday test is obvious for the coated pipe is tested for voids using an electric spark. Therefore, it would be useless to use a coating that

TABLE 1. BROAD SPECIFICATIONS

Enamel	Narrow Range Min.	Narrow Range Max.	Moderate Range Min.	Moderate Range Max.	Wide Range Min.	Wide Range Max.
Specific gravity 25° C	1.40	1.55	1.40	1.50	1.40	1.50
Softening point ASTM, D-36-26° F	180	200	180	200	220	
Penetration ASTM, D-5-25						
100 g., 5 sec., 77° F	0	2	2	6	7	20
50 g., 5 sec., 115° F	0	8	10	30	14	50
Ash mineral filler residue on ignition ASTM D271						
Sag test: 3/32-in. coating on 12-in. by 12-in. by 7/32-in. steel plate, in oven at prescribed temperature, vertical						
5 hr at 120° F	1/32 in.					
5 hr at 130° F			1/32 in.			
24 hr at 160° F					1/32 in.	
Cold test: Run on plates after sag test						
5 hrs at 30° F	no cracking or disbonding					
5 hrs at 0° F			no cracking or disbonding			
5 hrs at −20° F					no cracking or disbonding	
Stripping test: Peel test, 3/32-in. coating on ½-in. by 12-in. by 12-in. steel plate tested after pouring and at each 20° F increment up to sag test temperature, 1 hr at each temperature	⅛-in. max. to 120° F		⅛-in. max. to 130° F		⅛-in. max. to 160° F	
Holiday, Jeep test: Maximum ½-in. spark 1/16-in. coating thickness. Number of holes per sq ft...	none		none		none	



Left, opposite: Craneway view of 6 of the 9 Cooper-Bessemer LSV-16's driving General Electric A.C. generators for over-all plant service. Both these and the O.C. potline units, 42 Cooper-Bessemers in all, are completely protected from any type of operating damage by automatic shutdown devices with suitable anticipatory alarms.

Above: Line-up of 16 of the 33 Cooper-Bessemer LSV-16, 3,700 hp gas engines, driving General Electric O.C. generators, for powering pot line No. 1 in Reynolds' new Corpus Christi aluminum reduction plant.

RECORD-BREAKING is right! There's no other electric generating facility in the United States that can match the low cost power of the Reynolds Metals Company's huge new aluminum reduction plant at San Patricio near Corpus Christi, Texas.

Shown here are some of the 42 big Cooper-Bessemer LSV gas engines that help make this remarkable economy possible. These are 3,700 hp, spark-ignited, 4-cycle, 16 cylinder *supercharged* engines—Cooper-Bessemers with a thermal efficiency that consumes only 10 cubic feet of gas per kilowatt hour. To give you a rough idea, these Cooper-Bessemers at Reynolds Metals *save* enough *daily* to serve a city of 25,000 population.

Add to this efficiency the fact that these Cooper-Bessemers are quiet, smooth-running engines, designed for continuous operation. You'll find that it means, as usual, exceptional economy and satisfaction *plus*.

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TABLE 2. NORMAL SPECIFICATIONS

Enamel	Narrow Range Min.	Narrow Range Max.	Moderate Range Min.	Moderate Range Max.	Wide Range Min.	Wide Range Max.
Specific gravity 25° C ASTM D-71-27	1.45	1.55	1.40	1.50	1.40	1.50
Softening point, ASTM D-36-26 °F	190	200	190	200	220	
Penetration ASTM D-5-25						
100 g., 5 sec., 77° F.	0	2	2	6	7	11
50 g., 5 sec., 115° F.	0	8	10	20	14	28
Ash, mineral filler, residue on ignition, % ASTM D-271-37	20	25	20	25	20	25
Sag test: 1/16-in. to 3/32-in. coating on 12-in. by 12-in. steel plate						
5 hrs at 120° F.	1/32 in.					
5 hrs at 140° F.			1/32 in.			
24 hrs at 160° F.					1/32 in.	
Cold test: On sag test plate above						
5 hrs at 30° F.	no cracking or disbonding					
5 hrs at 0° F.			no cracking or disbonding			
5 hrs at —20° F.					no cracking or disbonding	
Stripping test: 1/16-in. to 3/32-in. coating on ½-in. by 12-in. by 12-in. steel plate. Tested after 1 hr at 20° temperature increment from 80° F to top temperature	⅛-in. max. to 120° F		⅛-in. max. to 140° F		⅛-in. max. to 160°F	
Holiday test: Approx. 10,000 volts, ½-in. spark, run on sag test plates	No Jeeps		No Jeeps		No Jeeps	

Note: For these tests, plates are to be primed with the specified primer at the specified rate and allowed to dry at least 8 hrs at 77° F and 50% relative humidity before pouring the enamel. Plates to be set at an angle of 30° for pouring.

broke down under such test. High electrical resistance is expected and the spark test is one assurance of high resistance.

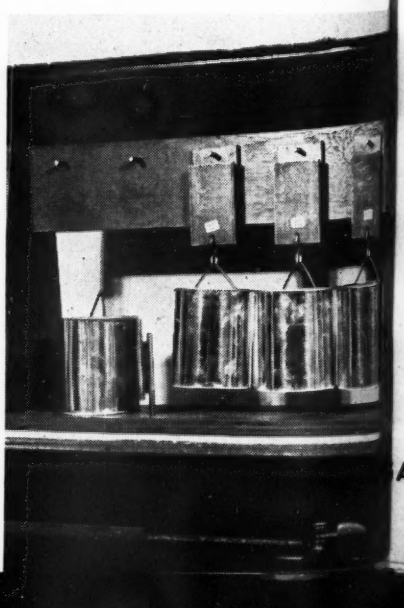
Perhaps, after this preliminary discussion of performance and specification the importance of adherence to the specification can be brought out more forcefully. Consider the individual coatings and their normal specification limits. The narrow-range enamel cannot be changed too much by the manufacturer except from the standpoint of softening point and filler content. Going over the specified softening point increases slightly the brittleness of the product and raises its cold cracking temperature. Normally, an overstepping of the maximum softening point does not radically raise the cold cracking temperature. However, going below the minimum softening point does decrease the cold cracking temperature and also increases the cold flow of the coating. In general, it would be better to go over rather than under the softening point. Talc fillers within the limits of about 20 to 30% do not radically change the viscosity of the product at application temperature, neither do they greatly change the brittleness or the cold cracking temperature. Upwards of 40% normal talc filler renders the coating viscous at application temperature, causes coking in the kettles and raises the cold cracking temperature. Each type of filler has a percentage range through which it has much the same characteristics as the talc. The manufacturer knows these and should specify them.

The softening point range and filler content of the moderate-range and the wide-range enamels is just as important as for the narrow-range product. However, overstepping the softening point does not usually affect the cold cracking temperature if the penetration is within range. Penetrations are very important for they are a measure of the softness of the product. Many times the coating for oil and gas lines is purchased from more than one supplier for the same line. The purchase is made on the basis of a manufacturer's product and the others on an "or equal" basis.

If, for instance, a moderate-range enamel is purchased on the specification of a 2 to 6 penetration range at 77° F, and is strictly adhered to by one manufacturer while another supplies the same softening point product but the penetration is around 10, then the second product is going to be much softer on the pipe and in warm weather application will set up slow, squeeze out and jeep under the skids. If the in-service line temperature is high, then that same coating will be soft and subject to puncture and to soil stress to a much greater extent than the originally specified material. This is particularly true of the moderate and wide-range products. With the wide-range product a penetration of below 7 normal means that the product will crack at minus 20° F, yet even at a 2 penetration it should still pass a minus 15° F cold test. Owing to normal in-service pipeline temperatures, it would be better to sacrifice the five-degree cold cracking temperature with lower penetration than to have a higher-than-specification penetration with consequent softness.

References have been made to in-service pipeline temperatures. Frankly, it is doubtful that much thought has been given to the temperatures existing on the buried pipelines. We have been too much concerned with the atmospheric temperatures existing at the time of application and installation of the pipeline. Thus, the temperatures that do exist come somewhat as a shock. A number of the companies have been kind enough to give temperature data. In most cases there is no data about the actual pipe temperature along the lines between the pumping stations, but there is plenty of data covering the suction and discharge temperatures at the pumping stations. Naturally, these temperatures reflect the pipe temperatures. Crude oil and petroleum products are not heated appreciably by pumping so that the suction and discharge temperatures at the pumping station are about the same; thus the pumping station temperature is in all probability the same as the pipe temperature. In gas transportation, the gas is heated by the compressors so that if the gas is not cooled as it leaves the compressor station it enters the pipeline at a fairly high temperature and is gradually

New test being used to determine simulated soil stresses, referred to in the text as shear stress measurement.



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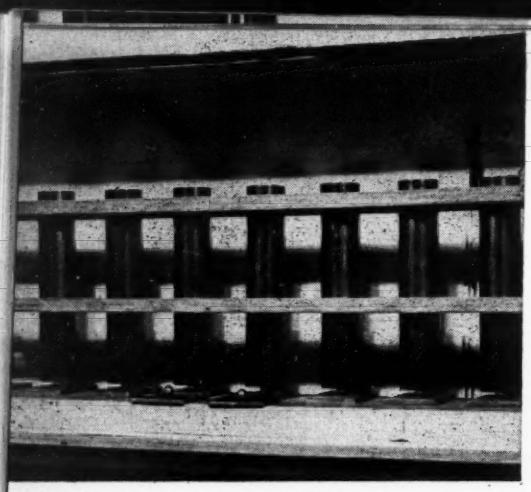


Testing coatings for resistance to blunt objects, using steel balls ½ in. in diameter.

reduced in the pipeline by the ground as it flows to the next pumping station. Thus, the suction and discharge temperatures somewhat closely represent the range of the pipe temperatures between pumping stations. *Table 3* gives these temperatures on various pipelines in a few areas of the country.

Frankly, there is very little data available on the present coatings as to their behavior subjected to the temperature ranges existing on the pipelines as shown in *Table 3*. Attempts are being made to devise methods to make such determinations in the laboratory, but with the small amount of data now available it cannot be said that any particular test methods are correct or give the type of information desired. The stress test, described at the beginning, has shown promise of reliable information and the pressure tests look promising. It may be interesting to examine some of the data obtained from the shear stress test and a modification of the penetration test (*Tables 4* and *5*).

Conclusions in *Tables 4* and *5* must not be made for there is not enough data. There are indications, for instance, that stress measurements indicate that at between 60 and 70° F the three grades of enamels may resist stresses at about the same rate. It is also indicated that care in selecting the coating is important if the service temperatures are to be higher. The flat needle penetrations indicate that for each enamel there is a somewhat critical yield point below which the penetration change is gradual with change in temperature, but beyond the yield point the change is very rapid.

An examination of the data in *Tables 4* and *5*, particularly with regard to the off specification, high penetration, moderate and wide-range enamels, gives some indication why the specification must be rigid on these materials. Although not shown in these tables, lowering of the softening point below specification on these two enamels, even though the penetration is within limits, would cause even greater penetration under the tests.

The manufacturers are in the habit of making enamels that are produced to meet specifications as given here. With reasonable care they need never go below the minimum softening point or above the maximum penetration limits. They may occasionally go over the maximum softening point or drop below the minimum penetration but this does not greatly alter quality or performance. Hence, the user needs only to be certain that the manufacturer produces his product so that it does not go below the minimum softening point or above the maximum penetration.

In spite of the need for specifications and adherence to the specification, specific data are sadly lacking and it would be foolish to try to write industry-wide specifications at the present time. In fact, it is doubtful that "industry-wide" specifications would ever be warranted because no two localities have the same conditions.

So until a concerted joint effort by manufacturers and users produces sufficient data to produce coatings better suited to the work to be done, purchases must be made on present available materials, holding them within specification limits.

Adapted from a talk given at a recent meeting of the National Assn. of Corrosion Engineers.

TABLE 3. GAS TRANSPORTATION LINES

Line Location	Time of Year	Pumping Station Temperatures °F Suction	Discharge
Ohio	August	67	115
Kentucky	August	70	116
Louisiana	August	88	150
Louisiana	February	64	124
Mississippi	August	82	136
Mississippi	February	59	115
Illinois	August	80	147
Illinois	February	56	116

TABLE 4. SHEAR STRESS MEASUREMENTS

Enamel Area: ¼ in. x 2½ in. x 2½ in. Test Weight: 20 Lbs.

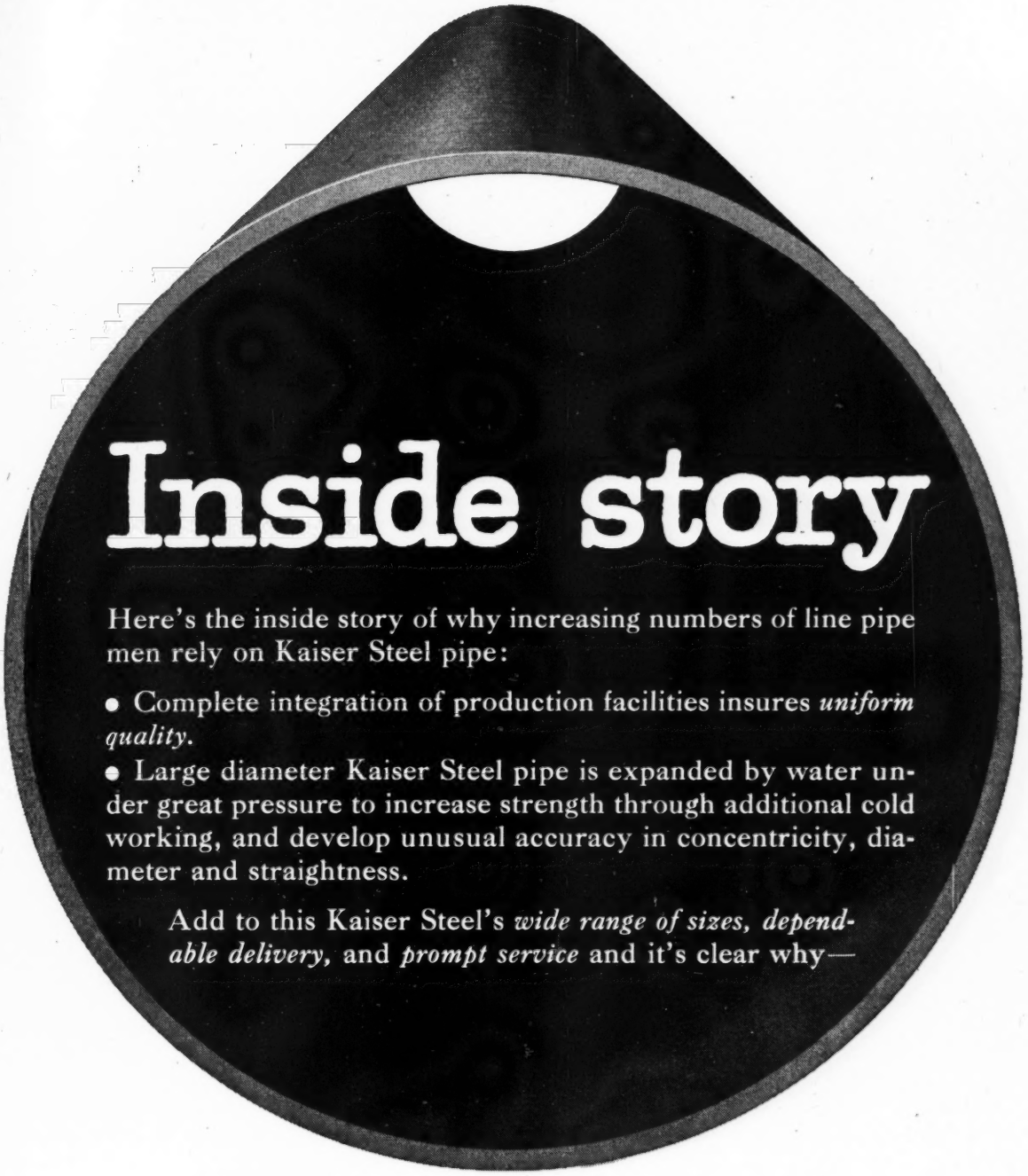
Type Enamel	Softening Point °F	Penetration 6 100 g. 5 sec. 77° F	50 g. 5 sec. 115° F	Movement in 64ths per 24 hrs at 77° F	at 90° F
Narrow Range	203	5	7	0.5	3
Narrow Range	187	0	1	0.5	1
Narrow Range	199	0	1	0.5	1
Moderate Range	199	2	11	2.0	6
Moderate Range	195	2.5	15	2.0	5.5
Moderate Range	205	2.5	13	2.0	4
Moderate Range	196	8	29	5.0	14
Wide Range	217	8	20	4.0	14
Wide Range	234	12.5	27	9.0	29

TABLE 5. PENETRATION MEASUREMENTS AT VARIOUS TEMPERATURES

Needle: Flat End, 1 mm Diameter; 100 g. wt., 60 Seconds

Type Enamel	Softening Point °F	Penetration 100 g. 5 sec. 77° F	50 g. 5 sec. 115° F	Flat Needle Penetration Depth of Penetration in 0.1 mms 77° F	115° F	130° F	140° F
Narrow Range	194	1.0	7	0	9	40	95
Narrow Range	187	0	1	0	4.5	44	175
Narrow Range	199	0	2	0	5	54	198
Moderate Range	194	2.5	14	0.5	25.5	70	104
Wide Range	235	9	18	1	34	55	93
Wide Range	238	7	15	0.5	25	44	71
Wide Range*	228	5	14	0	8	45	66
Wide Range*	228	3.5	10	0	3.5	7.5	33

*These two are special coatings outside the specification range.



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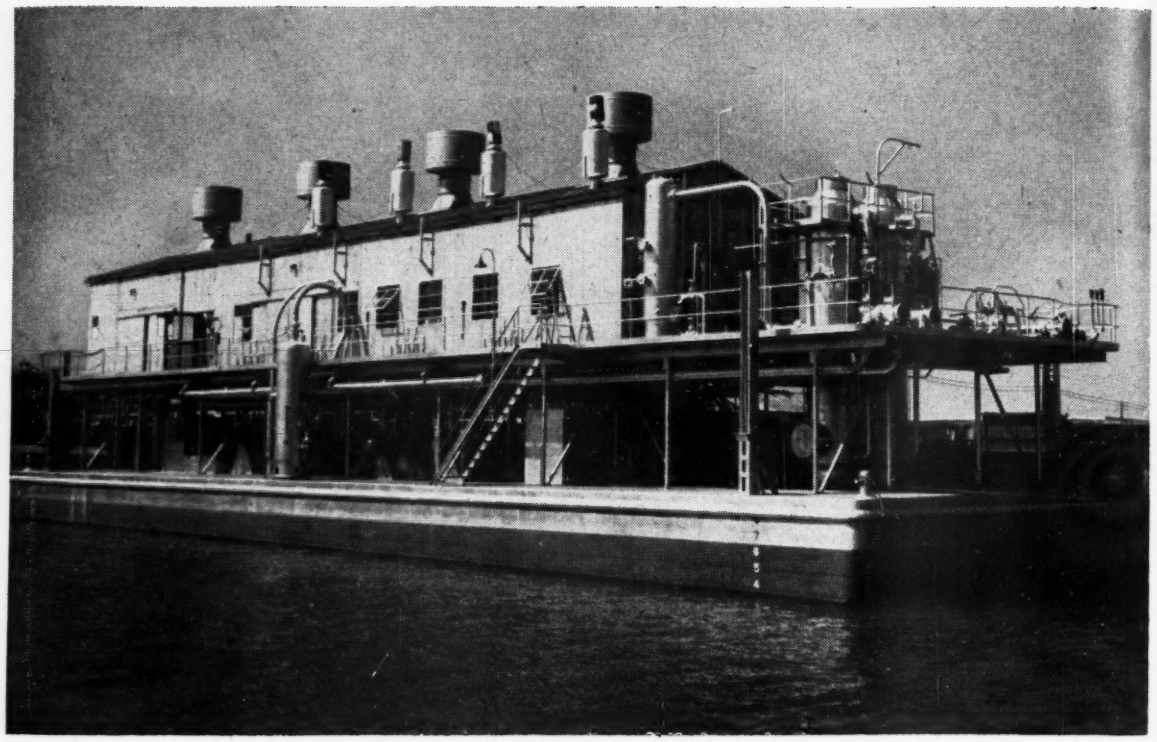
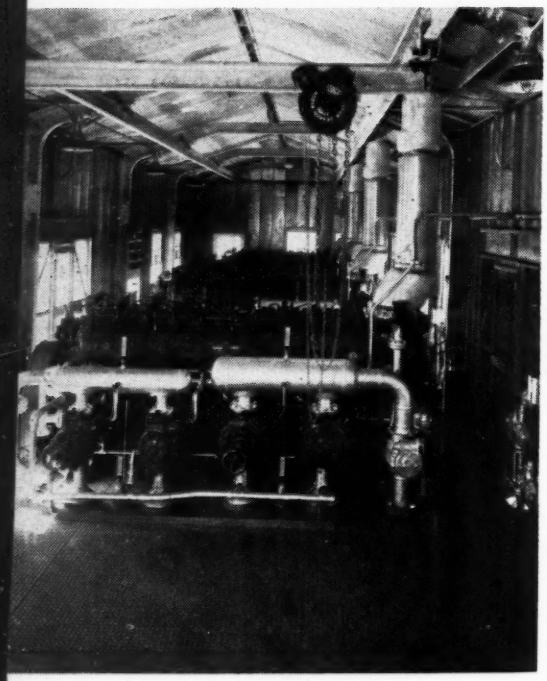
Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅛" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	22" to 30" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser

Prompt, dependable delivery at competitive prices • KAISER STEEL CORPORATION Los Angeles, Oakland, Seattle, Portland, Houston, Tulsa, New York



One of the three compressor barges built for Gulf Refining Co. now in operation in the Mississippi Delta area.

Sea-going compressors



Interior of the engine room on one of the barges.

IN recent years, as more and more of the gas industry's operations have taken place in bays, bayous, and the swampy areas along the Gulf Coast, the need has grown for equipment designed especially for these projects.

At first the equipment was installed on solid concrete foundations that were supported on pilings and were inaccessible from land. This method was too expensive, however, as little of the equipment could be salvaged when it was necessary to move the plant.

Several attempts were made to find a more satisfactory solution. Many small compressor plants mounted on floating barges were designed but none of them completely solved the problem, although a number have been in operation for some time.

Little further progress was made until officials of the Gulf Refining Co. in Houston, believing that a more satisfactory solution could be found, gave specifications to several shipyards on the Gulf Coast for a large-capacity plant that could be made either stationary or portable as needed. Bethlehem Steel Co.'s Beaumont yard was the successful bidder.

Marine engineers and naval architects from the yard worked in cooperation with Gulf's engineers to design the barge. They were finally successful and the first three barges to be built are now operating in the Mississippi Delta area of Louisiana. These three units have now been in operation for over six months and the results have shown that their design is far more efficient and economical than any other method of offshore operations yet devised.

Each barge measures 128 ft by 36 ft by 10 ft deep and is equipped with five gas engine driven compressors rated at 300 Btu. Each also has a dehydrator unit with a capacity of 15 MMcf per day and all the other equipment necessary to the operation of a compressor station.

The barge is towed to the job site submerged, and anchored with four spuds. It is submerged by filling the ballast tanks with water. When it is necessary to move the unit, it can easily be floated by reversing the procedure and discharging the water in the ballast tanks overboard. In this way, the barge and all its equipment can be towed to a new location whenever it becomes necessary.

Adapted from an article appearing in Rockwell Mfg. Co.'s *Flow Line*.

On varied field applications like these . . .

Johns-Manville TRANTEX *polyvinyl* TAPE

gives lasting protection against pipeline corrosion!

ON JOB AFTER JOB, Johns-Manville Trantex Tape is controlling corrosion and extending the service life of underground gas and oil pipelines.

Trantex is a durable plastic tape that sticks on contact—bonds tightly to the pipeline. No heat or heavy duty equipment is needed in its application. It is easily applied by hand or by specially developed hand-operated machines. Many users have found that field-applied Trantex Tape speeds coating applications . . . lowers construction costs on both large diameter transmission lines and gas distribution systems.

Trantex Tape is a development of Johns-Manville—a pioneer in the manufacture of Asbestos Pipeline Felts. For further information about Trantex Tape, write for copy of PP-26A, Johns-Manville, Box 60, New York 16, N. Y.

	*V-10	**V-20
Dielectric Strength per mil thickness, Approx.	1,000 V	1,000 V
Insulation Resistance, greater than (ASTM-D-257-49)	100,000 megohms	100,000 megohms
Temperature Limit	200 F	200 F
Adhesion oz. per inch width	30	20
Tensile Strength lbs. per inch	30	56
Elongation at Break	250%	300%

"Trantex" is a black polyvinyl tape. It is available in two thicknesses—

*V-10 is a 10 mil tape for average conditions, and

**V-20 is a 20 mil thickness for use where a more rugged coating is specified, such as to repair enamel coatings.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANTEX *polyvinyl* TAPE

PROTECTS PIPELINES AGAINST CORROSION

PIPELINE NEWS

Texas Gas completes major part of loop line

The Texas Gas Transmission Corp., Owensboro, Ky., has won its race against winter to get gas flowing to customers in eight midwestern states in time to meet peak load demands. In a little more than four months the company has constructed and put into operation 332 of the 408 miles of 26-in. loop line parallel to its main 26-in. natural gas pipeline. When completed the new construction will increase delivery capacity by 240 MMcf to a total of 950 MMcf per day.

Early last month utility companies in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, Indiana, Ohio, and Illinois were receiving increased amounts of gas from the new line, which stretches from Louisiana to Kentucky. Vice President L. E. Ingham reported that a substantial portion of the 240 MMcf, sufficient to provide the large supplies needed to meet peak load demands of this winter, was being delivered to Texas Gas customers. Tie-overs were being completed between the new line and the main 26-in. artery to bring the line to its top capacity.

Governor advocates new Texas pipeline tax

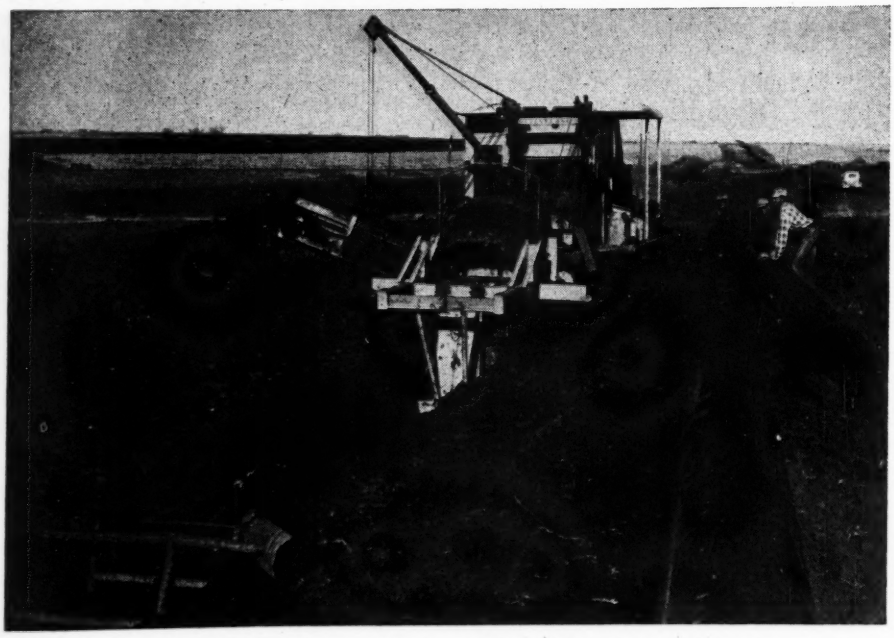
An additional tax on long-distance natural gas transmission lines was suggested by Gov. Allen Shivers of Texas last month as a means of increasing state revenues.

He asked the state legislature to consider the additional tax "if that is found to be practicable under existing legal circumstances." He reminded the lawmakers that the court fight against the Texas gathering tax has tied up some $40 million in current and anticipated funds. "With those funds, we would have little or no financial problem at this time," he said.

Commissioner predicts tripling of wellhead price

A new high price for Texas natural gas, nearly three times the average price now being paid, was predicted last month by Texas Railroad Commissioner Ernest O. Thompson. The price of gas at the wellhead will be the hottest oil and gas problem in Texas in 1953, he stated. This will be evidenced by legislation seeking to raise prices in a minimum price-fixing law and also aid in solving the state's need for new tax revenue.

The current average price of natural gas is 5.25 cents per Mcf. Federal regulations have held the top price for gas sold through interstate lines at 10 cents per Mcf, but contracts as high as 12.5 cents have been obtained during the year in the east Texas field near Marshall. Mr. Thompson said it was his understanding that contracts have been made or offered recently at the rate of 15 cents.



Construction of a 23-mile loop on Northern Natural Gas Co.'s 26-in. line, between Clifton, Kan. and Beatrice, Neb. compressor stations, progresses across the flat prairie. Favorable weather will enable crews to complete the job by early spring. This is part of the construction planned to raise capacity of Northern's line to 825 MMcf; this loop will add 20 MMcf daily.

Pacific Northwest case goes before FPC this month

The hearing, scheduled to begin Feb. 1[illegible] on the application of Westcoast Transmission Co. and others to serve the Pacific Northwest, is expected to be a long-drawn-out affair, with terrific opposition to the importation of gas from Canada by two sources in this country—Pacific Northwest Pipeline Corp. which wants to serve the market with an all-American system, and the coal interests, including the coal-hauling railroads who are bitterly opposed to tapping a new source of natural gas, from Canada, Mexico or anywhere else.

Pacific Northwest already has employed able counsel, advertising representatives and public relations men to sell its case to the public, even in advance of the hearings. Congress is feeling the heat from all three competing groups. Seattle Gas and most of the other Washington distributors have renewed their contracts giving Pacific Northwest until June 30 to obtain a permit from the FPC. Previous contracts expired Dec. 31.

In the meantime, Seattle Gas Co. officials were making the most of the electric power shortage in the Pacific Northwest by reminding Seattle citizens with a large newspaper ad that gas is power too and pointing out how and where gas can help in "this disastrous power shortage."

Twenty new gas fields found in Mississippi

When a 5571-ft well in Muldon field, Monroe county, blew in December, [illegible] brought to 20 the new gas fields discovered during 1952 in Mississippi. A spokesman for United Gas Co., owner of the well, said the discovery "proves commercial natural gas reserves in the Muldon field and establishes the existence of blanket sands that can be depended upon to produce."

During the year a total of 315 wells were drilled in the state. Of these, 102 were completed as producers, including the 20 wildcats successfully establishing new fields, and 82 development wells drilled in proven fields. The 20 new field discoveries surpassed the record of 15 finds set in 1951.

Both sides sure of victory in fight for New England

As the battle for the New England [illegible] market dragged on before the FPC last month, attorneys for both Northeastern Gas Transmission Co. and Algonquin Gas Transmission Co. expressed confidence in victory but neither side would indicate what action it would take in the event of an unfavorable decision.

Latest developments include a ruling by the U. S. Court of Appeals in Boston against Algonquin's attempt to force the FPC to issue a temporary certificate of necessity

holding that FPC was correct in its stand, taken last October, that it had no authority to issue a temporary permit.

Northeastern took a series of full-page ads in the *New York Times* "in the public interest to present the true picture," arguing that approval of its application to serve all New England would save consumers nearly $5 million a year.

FPC granted temporary authorization to Texas Eastern Transmission Corp. to sell its present customers the gas that it had contracted to supply to Algonquin, and also dismissed a motion by Tennessee Gas Transmission Co. to allow that company to increase sales to Northeastern from the presently authorized 220 MMcf to a new maximum of 404 MMcf.

Transcontinental dedicates new microwave system

The Transcontinental Gas Pipe Line Corp., of which Claude A. Williams is president, was in the Washington limelight recently when Dr. W. R. G. Baker, vice president of General Electric and general manager of its Electronics division, presented a master key to the world's longest private system of microwave radio communications to Mr. Williams in brief but impressive ceremonies.

The presentation was made at a dinner attended by Transcontinental and G-E officials, at which the system was accepted formally. Engineered and built by General Electric at a cost of $1.5 million, the system was completed in December. It is now operating along the 1840-mile Trancontinental pipeline from Falfurrias, Texas, to Newark, N. J.

Consisting of a chain of 59 microwave stations relaying extremely high-frequency signals from one to another in narrow flashlight-like beams, it provides the equivalent of 12 telephone lines or channels.

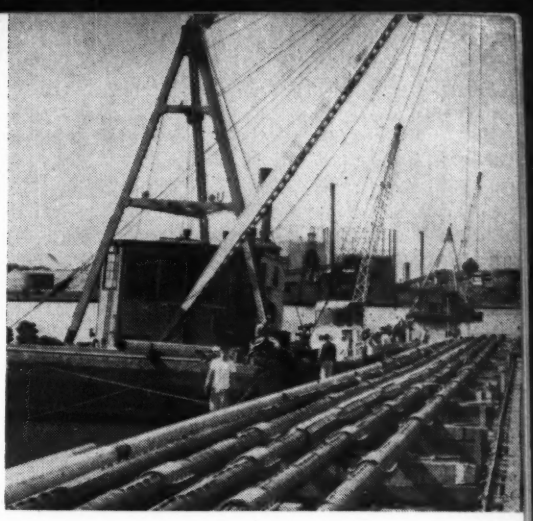
Sooner or later, the system can be adapted so that officials at either end of the line can get reports automatically on meter readings at various compressor stations. All in all, it is viewed as a tremendous step forward in communications for pipeline companies.

It is estimated that a 1000-mile, six-channel communications system would require 30,000 to 40,000 lbs of copper if done by microwave, and more than 3 million lbs if done by open wire pole lines. The microwave system costs about half as much as the wire lines.

Texas Eastern, Wilcox to build 532 miles of line

The Texas Eastern Transmission Corp., Shreveport, and Wilcox Trend Gathering System Inc., Dallas, have been authorized to construct pipeline facilities in Texas and Louisiana at a total cost of nearly $34 million.

Wilcox will sell about 100 MMcf to Texas Eastern and will construct about 217 miles of line—157 miles of transmission pipe from



These 400-ft sections of pipeline are ready for placement on narrow gauge trollies (right) before the line is pulled across the harbor to the plant of the Providence Gas Co. in background. All welded joints are inspected by X-ray to detect any possible flaws before the line is submerged.

Trollies roll new line across river

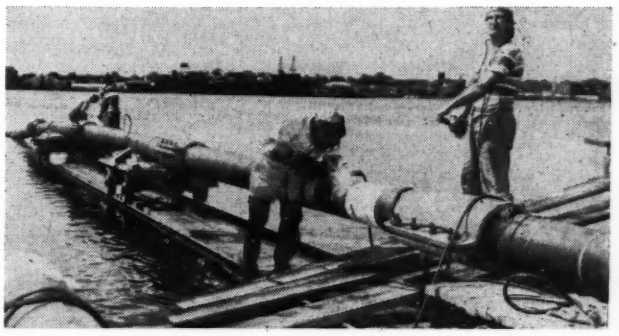
Merritt-Chapman & Scott demonstrated once again that there is a different way to lay a pipeline underwater for each set of local conditions when they recently laid three 10-in. lines for the Providence (R. I.) Gas Co. across a river just below the city's half-mile-wide harbor.

To avoid interference with marine traffic they first built a 40-ft wide pile-supported trestle almost 500 ft out from one shore. This paralleled a 15-ft deep, 40-ft wide trench dredged across the harbor bottom 50 ft below river level.

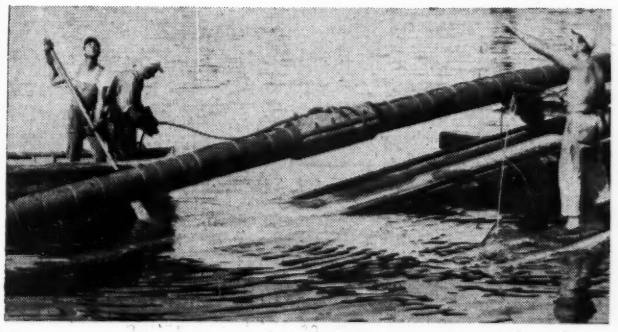
Atop this trestle, 40-ft lengths of protectively coated pipe were welded into a single 400-ft section, and placed on miniature flat cars mounted on a narrow-gauge track.

This section was then pulled into the river from the opposite shore, until only its aft part remained above water. To this was welded another 400-ft section, which also was pulled into the water, and so on, until the line reached the opposite shore. The last section remaining on the trestle was lowered into the trench by floating derricks.

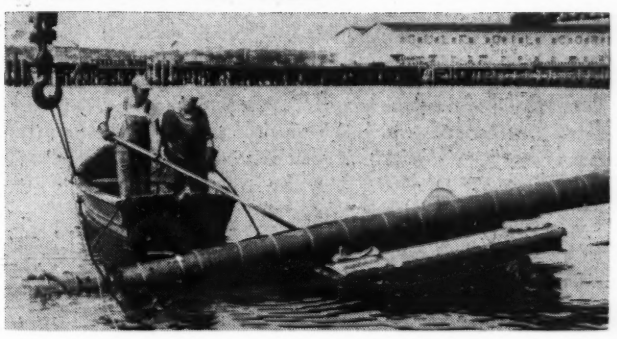
Adapted from an article appearing in Merritt-Chapman & Scott's *Black Horse News*. Photos courtesy of *Providence Journal-Bulletin*.



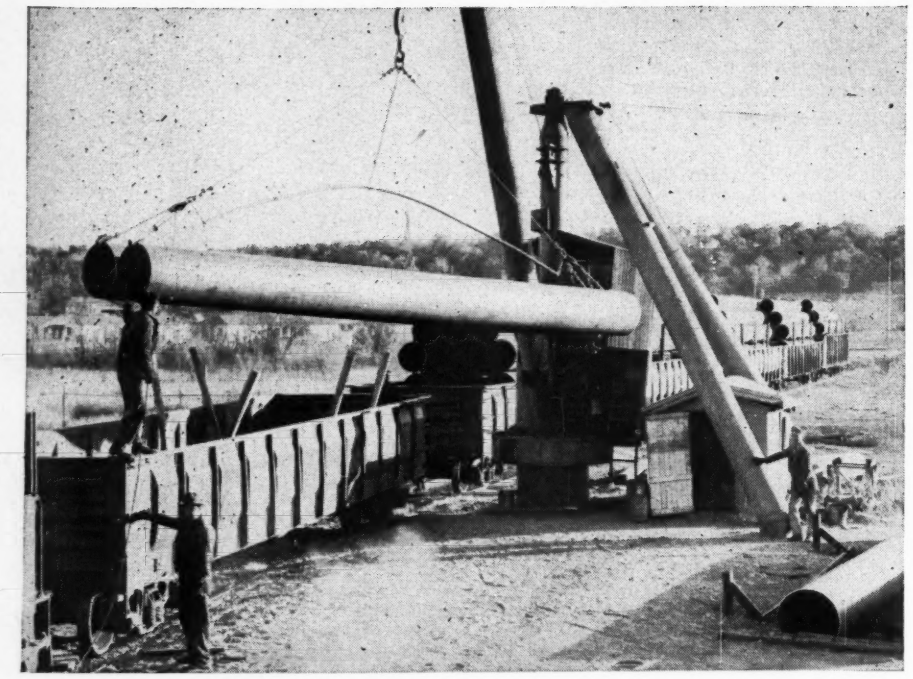
A pipe length is welded to the end of the lead pipe after the latter has been pulled into the river by winches.



The long trestle on which the trollies move slopes gently, starting at 6 ft above water, and ending slightly beneath the surface.



As the pipe sinks, the trollies float to the surface and are retrieved by floating derrick.



This shipment of 5000 ft of pipe fabricated by Master Tank & Welding Co., Dallas, is being loaded for routing to PG&E subsidiary, Standard Pacific Gas Line Inc., San Francisco. The 26-in. pipe will replace electrolytically damaged portions of original pipe.

a point in McMullen county, Texas, to a connection with the Texas Eastern system near Provident City, and about 60 miles of lateral lines—and a 2200-hp compressor station.

Texas Eastern's authorization covers construction of a 315-mile pipeline.

Cities Service storage project planned for Kansas field

Details of a $4 million storage project in the nearly exhausted McLouth gas field in Kansas were announced last month by the Cities Service Gas Co. of Oklahoma City.

In order to put the field into operation for storage, the company must clean out and plug about 122 old oil and gas wells. An additional 84 wells to be used for injection and withdrawals will have to be cleaned out and repaired. It will also be necessary to build a gathering system and a tie-in pipeline requiring about 315,000 ft of pipe. The project is scheduled for completion and service during the winter of 1954-55.

Certificate required for continued operation

A recent FPC order finds that the Ohio Fuel Gas Co., Columbus, must have FPC certificates for the continued operation of natural gas pipeline facilities that were constructed in 1950. Ohio Fuel had asked the commission to disclaim jurisdiction over the facilities, or, in the alternative, for certificates authorizing their construction and operation.

The decision also said that the sales Ohio Fuel makes to National Fireproofing Corp.'s plant at Haydenville, Ohio, are sales of natural gas in interstate commerce for resale for ultimate public consumption and the company is required to file an executed service agreement for this sale.

Nearly $150 million in rate boosts asked in '52

A total of $148,953,000 annually in wholesale natural gas rate increase applications filed by 30 companies was acted on by FPC during 1952. This total represents a 65% increase over 1951. The commission suspended nearly all of these increases pending hearings, let only $852,000 of them go into effect immediately.

Of the suspended filings, $23,463,000 were allowed to take effect during the year; $7,750,000 were disallowed, and companies were permitted to withdraw $4.7 million. Of the remaining $109,188,000, a total of $8,586,000 became effective under bond during the year, leaving $100,602,000 still under suspension.

During the 12-month period, FPC completed proceedings which were pending at the close of 1951, amounting to $56,355,000. This total includes $20,395,000 allowed to become effective, $29,514,000 disallowed and $6,446,000 withdrawn. Carryovers from 1951, added to rate increases filed during the year, total $95,268,000 increases involved in proceedings concluded in 1952. Of this amount, $46,858,000 was allowed to become effective, $37,264,000 was disallowed and $11,146,000 was withdrawn. At the end of 1952 more than $71.5 million per year in increased rates was being collected under bond.

Expanded drilling program planned for Saskatchewan

Sohio Petroleum Co. and Socony Vacuum Exploration Co., Regina, have announced agreements involving an expanded exploration and drilling program in Saskatchewan. Socony will acquire from Sohio one-half interest in approximately 5 million acres of land and will be operating manager for the jointly owned acreage, much of which is in the Williston Basin area of Saskatchewan. Mineral rights on the land belong to the government and the agreements between the two companies have been approved by the minister of natural resources.

Socony's three-year program includes an active schedule of exploration work and test drilling. As a result of this program it expects to expand its technical and operating staffs in the province.

Regulation of New Mexico gas production postponed

The New Mexico State Oil Conservation Commission deferred action until August 1953 on proposed regulation of gas production in the state, after gas producers told the commission they have been so busy expanding in the Blanco-Mesa Verde pool of the San Juan Basin that they have not been able to gather sufficient definite facts to base a prorationing program on.

Stanolind Oil & Gas Co. asked the commission more than a year ago to set up a system similar to that regulating oil production. Postponement of the case was favored by all San Juan producers present at the hearing, including Stanolind, El Paso Natural Gas Co., Southern Union Gas Co., Delhi Oil Corp., and Beaver-Lodge.

Recent agreement gives Union Gas good reserves

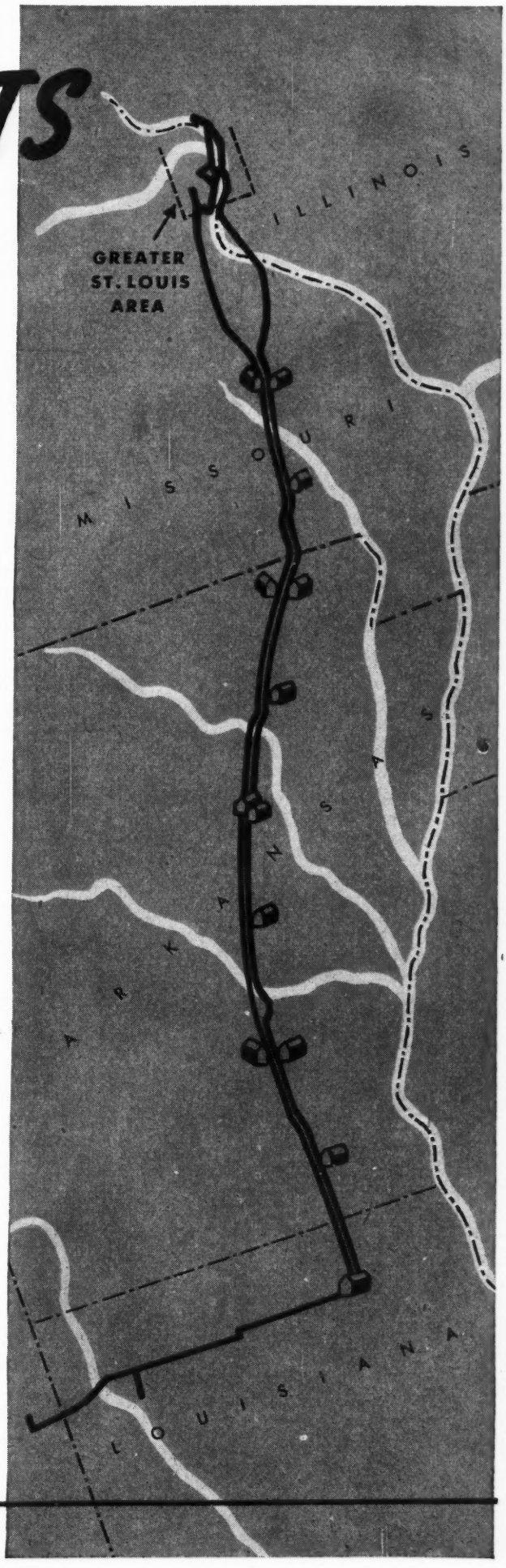
A gas supply agreement made recently between Union Gas Co. of Canada and Imperial Oil Ltd. places Union Gas in its best gas reserve position of many years. Under the agreement, Imperial will supply Union, from its southern Ontario gas fields, with 5 billion cu ft of gas annually for a period of 15 years. This, plus the 5.5 billion cu ft it receives from Panhandle Eastern Pipe Line Co., Kansas City, provides a potential of 10.5 billion cu ft a year. Current sales are about 9 billion cu ft annually.

Ruling on Texas-Ohio line designated "tentative"

FPC has redesignated as tentative rather than final, its denial of applications by Texas-Ohio Gas Co., Houston, for authority to construct a 1406-mile pipeline and to import natural gas from Mexico. Texas-Ohio and two interveners—the Public Utilities Com-

DRIVEN UNITS

CORPORATION'S VITAL NATURAL GAS LINE



The Mississippi River Fuel Corporation's two 431-mile pipelines supply *all* of the natural gas for the teeming metropolis of Greater St. Louis, leading industrial center of the Mississippi valley. Nineteen compressor stations along the 1466 miles of pipe line, including feeder and lateral lines, provide a capacity of four-hundred-million feet per day.

The gas is carried in two main lines—a low-pressure 22"-line operating at 450 psi and a high-pressure 22"-24"-line operating at 700 psi. The low-pressure line, started in 1929, includes five Ingersoll-Rand KVG gas-engine compressors and nine gas-engine generating units, totalling 7275 hp. The high-pressure line, put into operation in 1949, is served by 36 KVG compressors and 13 gas engine generating units, totalling 39,393 hp. (Two more KVG units are being installed on the line and four more are on order.)

Also included in nine of the compressor stations on the high-pressure line are two I-R Type 30 air-starting compressors. A number of the circulating-water pumps in many of the stations are Ingersoll-Rand, too—totalling more than 75 units. In addition, I-R Impactools and other I-R air tools are used in every compressor station for routine maintenance and plant servicing.

Ingersoll-Rand takes great pride in being able to contribute to the success of Mississippi River Fuel's gas transmission system and in the fact that the performance of *all* I-R equipment has been satisfactory.

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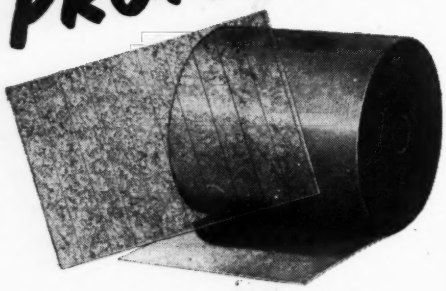

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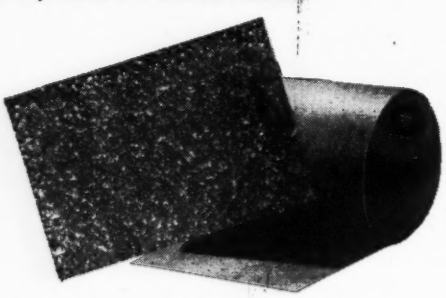

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mission of Ohio and Reserve Natural Gas Corp.—had asked for rehearing of the Nov. 7 opinion and order on the grounds that FPC had misconstrued statements made by Texas-Ohio counsel in asking for a final decision to mean they had waived the intermediate decision procedure. The company had until late last month to file exceptions to the tentative decision.

New drilling rigs reach to depths of 22,000 ft

Drilling rigs capable of going 22,000 ft, more than four miles, straight down, have been developed, according to recent reports. A decade ago 10,000 ft was the limiting depth of the drill—another ten years may find drillers exploring depths of 35,000 ft. Seventy wells in the United States have already been completed below 15,000 ft. One leading geologist says, "Oil men estimate that of 2.4 million sq miles of the earth where oil may exist, only 1% has been explored. But, consider what remains unexplored if this estimate were multiplied by cubic miles of depth that can be penetrated by the drill."

Chicago District seeks to build 35 miles of line

The Chicago District Pipeline Co., Joliet, Ill. has asked FPC approval to construct about 35 miles of gas transmission line in the Chicago area to enable it to meet increasing requirements of existing customers. Cost of the project, estimated at $5.5 million, would be financed by funds borrowed from Chicago District's parent company, the Peoples Gas Light & Coke Co. The program would include about 3.4 miles of 36-in., 31.2 miles of 30-in., and a river crossing of 24-in. pipe. Also, about 3.7 miles of existing lines would be abandoned.

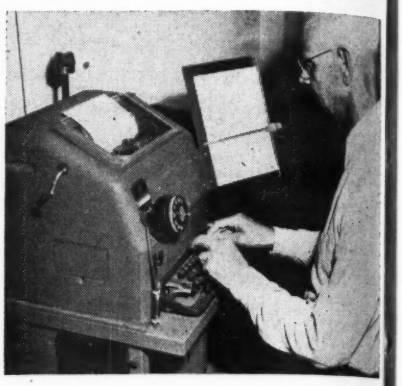
Northern Natural ordered to provide emergency gas

Affirming a presiding examiner's decision made last September, FPC has ordered Northern Natural Gas Co., Omaha, to connect its pipeline system to facilities of Public Service Corp. of Texas, Fort Worth, for deliveries of natural gas on an emergency basis. Northern is to make the deliveries solely for the purpose of meeting the emergency needs of Public Service's local distribution operations, such as those arising from a breakdown of its facilities or interruption of its usual supply caused by a breakdown of its supplier's facilities.

Old Timers awards to be presented at IPE

A feature of the next International Petroleum Exposition will be a contest conducted by an "Old Timers" committee to put the spotlight on men who have been in the oil business since "way back when." Awards for a "Grand Old Man" for each major division of the petroleum industry and a "Pioneer of Pioneers" will be made at the 1953 International Petroleum Exposition, May 14-23, in Tulsa, following a tradition started in 1927 by John D. Rockefeller Sr.

The Pioneer of Pioneers is selected on the basis of length of service and contributions to the industry, regardless of division. Candidates must have been active for at least 50 years. The "Grand Old Man" awards go to candidates active for at least 40 years who have made valuable contributions to their particular division. Six divisions are considered: Production, pipeline, refining, natural gasoline, gas, and equipment and supplies.



Tide-Water Pipe Co. Ltd., Bradford, Pa. recently installed this Bell system private line teletypewriter as part of its new communications system, designed to replace the company's privately owned Morse telegraph system connecting all offices and pumping stations on its 289-mile oil pipeline.

Storage gas to be owned by utility customers

FPC has modified the certificate issued last September to Natural Gas Storage Co. of Illinois, Chicago, to provide that its storage gas will be owned by utility customers of two affiliates of the storage company—Natural Gas Pipeline Co. of America and Texas Illinois Natural Gas Pipeline Co., both of Chicago—instead of by the affiliates themselves as originally authorized. The two companies will continue to sell to their customer utilities at present contract volumes but will make delivery to the storage company, for their customers' account, volumes of gas designated for storage by the customer utilities.

Work begun on El Paso Natural skyscraper

A contract was let early last month to Robert E. McKee General Contractor Inc., El Paso, for construction of an 18-story building for El Paso Natural Gas Co. Work was to begin immediately. The ultramodern sky-

Your communications are his specialty

Here's a man who rides herd on trouble. He works in the field, guarding your pipe-line communications against interruptions. In case of emergency, he's *out* there, ready and equipped to restore service quickly. While he works, other technicians may reroute your communications over an alternate circuit in the vast Bell System network.

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HOT DOPE

Straight from the Kettle on *PIPE PROTECTION*

★

By Boyd Mayes

A friend called up recently to learn why we'd missed out on several miles of big-inch that was going down almost under our nose. We told him we'd made an honest bid on the job, figured on a fair and reasonable profit, but had lost to a bid that couldn't, even by sleight-of-hand performance, do more than break even on the job. He asked why we didn't underbid the cost and chunk in enough "extras" to make our profit. We've got a stock answer for that one: In more than a quarter of a century of doing a creditable job for the pipe line industry we've followed the same old policy: "We refuse to laugh our way into a job, then cry our way out!"

★

MAYES BROS.

1150 McCarty HOUSTON, TEXAS OR chard 7566

scraper, to cost about $4 million, will be of structural steel design with walls of a light, fireproof plaster-type composition and hundreds of 6 x 6½-ft glass windows. Rectangular in shape, it will resemble the United Nations building in New York.

The general structure will rise 16 stories with two additional penthouse stories, to be second tallest in El Paso. The Hilton hotel is 21 floors and the Bassett Tower, 16. The now scattered offices of El Paso Natural will be concentrated in the new building.

Notes

The Mississippi State Supreme Court ruled last month that landowners in Mississippi whose properties are within a legal drilling unit must share alike in royalties from gas or oil although their properties may not be equally productive. Legal drilling units are areas designated for conservation purposes and, under proration, a limited number of wells may be drilled in a given area. The court's decision was based on a suit by the Humble Oil & Refining Co. against A. E. Welborn and others.

Chief Presiding Examiner Frank A. Hampton of FPC has filed a decision authorizing Iowa-Illinois Gas & Electric Co., Davenport, to construct 22 miles of natural gas pipeline at a cost of $500,000, and to continue operation of 23 miles of 4-in. and 17 miles of 10-in. line in its Ottumwa and Davenport, Iowa, districts. The new 22-mile line will connect with Natural Gas Pipeline Co. of America's system in Mahaska county and extend to a point in Ottumwa county, Iowa.

Texaco Exploration Co., Edmonton, Alberta, has applied to the Petroleum & Natural Gas Conservation Board for a permit to construct a gas absorption plant. The fourth to be planned for the area, the plant will be constructed at a minimum cost of $2 million. Wet gas from the Wizard Lake, Bonnie Glen and Pigeon Lake oil and gas areas southeast of Edmonton will be processed. Applications are also before the board from Barcam Ltd., Leduc Southern Absorption Ltd. and Progas Ltd. to build similar plants.

Oral argument was scheduled for Jan. 30 on issues presented by exceptions filed to the decision of an FPC presiding examiner, requiring United Gas Pipe Line Co., Shreveport, to make gas available to Willmut Gas & Oil Co., Hattiesburg, Miss., at the same lower rate, 17.5 cents, at which the company supplies Mississippi Valley Gas Co., Jackson, Miss. It has been charging Willmut 25 cents per Mcf.

The A. O. Smith Corp., Welding Division, Milwaukee, has begun construction of a new ultra-modern electrode plant in Lancaster, Pa., which is scheduled for completion by late July. Electrode manufacture at present is confined to the Milwaukee plant where all non-productive functions of the division will continue. At the same time the Welding Division has announced issuance of a 16-page catalog offering customers a complete line of welding accessories.

Claude A. Williams, president of Transcontinental Gas Pipe Line Corp., presents T. F. Reilly Jr., Richmond Borough works commissioner representing Borough President Cornelius A. Hall, with an old print of Staten Island at a luncheon following official opening of Transco's second pipeline into the New York area.

The American Petroleum Institute has announced the publication of "Tentative Standard for Field Welding of Pipe Lines" (API Std 1104), which applies to crude petroleum and petroleum products trunk lines and to natural gas transmission lines. The standard is designed to assure the production of the highest quality welds obtainable on a commercial basis by skilled welders using approved procedures, materials and equipment. It includes a section on radiographic inspection of pipeline welds.

Southern Union Gas Co., Dallas, recently won a $467,200 rapid tax amortization certificate for a gas pipeline in Lea and Eddy counties, Texas. The Defense Production Administration said the amount certified covered 25% of the total cost. Certificates are granted in relation to the defense necessity of the activities covered.

In a step aimed at increasing the development of additional gas reserves in the province, the Alberta government of Canada announced recently that, for the first time, a sale will be held this month of natural gas rights without accompanying oil rights.

The fourth annual Tulsa Short Course for Pipeliners has been scheduled for March 4-6. Planned specifically for foremen, superintendents, field engineers and inspectors, the school will cover "Practical Control of Pipeline Corrosion" by group discussions, lec-

tures and field demonstrations led by practical authorities. It is sponsored by the Tulsa section of the National Assn. of Corrosion Engineers and will be under the direction of a committee headed by W. A. Hutchison, chief corrosion engineer for Sinclair Pipe Line Co.

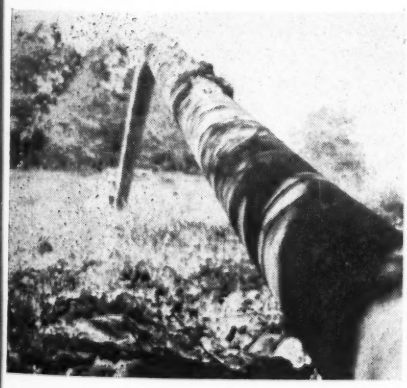
A rate increase of $15,278,000 has been made effective by FPC order subject to the posting of a $1.5 million bond by El Paso Natural Gas Co. The requested increase, filed in June, was suspended pending hearings, which had not been completed at the end of five months, allowing the increase to become effective under bond.

A 50,000-acre parcel of Southern Ute indian land in and near the Ignacio, Colo., pool is advertised for oil and gas leasing. According to Elbert J. Floyd, supervisor of the consolidated Ute agency, this is the first of three parcels of land, totaling 156,000 acres, scheduled to be leased by April.

Commissioner Harrington Wimberly of Oklahoma has been re-elected vice chairman of the Federal Power Commission for 1953. A member of the FPC since October 1945, he has served as vice chairman during 1952, 1948 and part of 1947.

The Texas Railroad Commission has indicated that it has dropped, at least temporarily, its controversial proposal to prorate gas on a statewide basis. (*GAS*, January.)

A permit for construction of a $300,000 natural gas pipeline and gathering system to feed the Fort Saskatchewan Sherritt-Gordon nickel processing plant has been granted Midwestern Industrial Gas by Highways Minister Gordon Taylor. Gas will be piped from Midwestern's four wells in the Fort Saskatchewan area, 20 miles northeast of Edmonton, Alberta.



Subsiding ground caused by coal mining created this hazardous condition on an Equitable Gas Co. line in West Virginia recently. The 12-in. line was suspended 8 ft in the air in some places. Over 2000 ft of the line had to be relaid.

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ENDS YOUR PIPE JOINT WORRIES-
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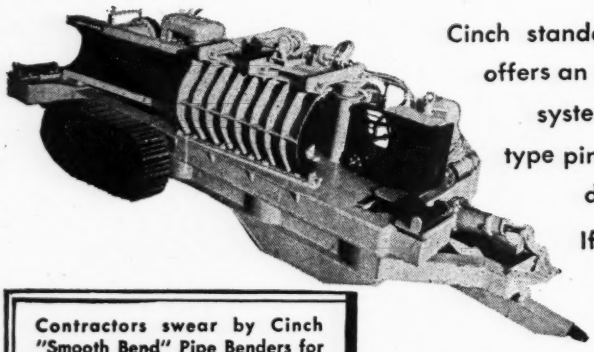

Cinch standard equipment now offers an improved hydraulic system and new wedge-type pin-up slide for greater durability and speed. If desired, even faster, easier maneuvering can be obtained with Athey tracks and hydraulic lift tongue.

Contractors swear by Cinch "Smooth Bend" Pipe Benders for dependability and uninterrupted service. Cinch Pipeline Equipment provides the most up-to-date equipment and expert maintenance.

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PIPELINE EQUIPMENT, Inc.

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No pipe can withstand the ravages of time and elements like Cast Iron Pipe — no pipe can give more economical and effective service than Cast Iron Pipe. Install it and forget it. It will be with you through the years.

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Pipeline People

LESLIE H. TAYLOR, Lone Star Gas Co., Dallas, has been promoted to district superintendent of compressor stations in the Ranger district succeeding SAM M. GAMBLE who has retired. Mr. Taylor was assistant district superintendent.

GEORGE B. MCMEANS has been appointed vice president in charge of operations for Kaiser Steel Corp. He will headquarter at the Fontana, Calif. plant where he has been works manager for the past two and one half years. At the home office in Oakland, J. M. COSGROVE has been appointed to the newly created position of manager of tin plate sales. Before working in development of the tin plate program he was northwest district sales manager at Seattle.

Manufacturers of the Unibolt products, Thornhill-Craver Co., Houston, have appointed TRACY T. WORD JR. as manager of sales. Mr. Word began his career in his father's company, the T. T. Word Supply Co., in 1934.

Tracy T. Word
Thornhill-Craver

E. A. Koenig
Texas Eastern

Former general superintendent of Texas Eastern Transmission Co., Shreveport, E. A. KOENIG, has been appointed vice president in charge of operations for Wilcox Trent Gathering System Inc., Dallas, a Texas Eastern subsidiary. Also transferring from Texas Eastern to Wilcox are J. C. RIDDLE, chief dispatcher, and S. L. WINDHAM, measurement engineer, both from division four. Replacing Mr. Koenig as general superintendent of Texas Eastern is H. M. MCDONALD who is succeeded as pipeline superintendent by PAUL L. HUGHEN. Other promotions include CARL R. SISSON, who replaces Mr. Hughen as manager of division three in West Chester, Pa., and MURRELL CARLISLE who replaces Mr. Sisson as assistant manager of that division.

Keplinger and Wanenmacher, petroleum engineers of Tulsa, have appointed JOSEPH B. BUSH as supervisor of gas appraisals. Mr. Bush has been with the firm four years and has had 20 years experience in appraising oil and gas properties.

T. O. KUIVINEN, recently appointed chief engineer's assistant with Cooper-Bessemer Corp., Mt. Vernon, Ohio, has been elected

Sigma Xi, national honorary society. He was accorded full membership in recognition of outstanding contributions to the engineering field.

M. A. Ellsworth

L. R. Lyon

M. A. ELLSWORTH, formerly vice president of the mid-continent area for The Fluor Corp. Ltd., has been appointed vice president and director of sales. He will headquarter at the main office and plant in Los Angeles. Former district engineer for Fluor's Tulsa sales office, L. R. LYON, has been appointed district sales manager of that office.

FENTON H. FINN has been elected president of New York State Natural Gas Corp., Pittsburgh. He was previously vice president of the company and system geologist for all Consolidated Natural Gas Co. subsidiaries.

Directors of the Tennessee Gas Transmission Co., Houston, have elected R. G. RICE as executive vice president. Other promotions also announced include CURTIS M. SMITH, vice president; JAMES E. IVINS, secretary and W. D. WALSER, controller. RALPH C. GRAHAM was designated executive vice president of the Tennessee Production Co., an affiliate of Tennessee Gas, and R. R. DEAN was elected vice president in charge of natural gasoline. SAM C. OLIPHAN, formerly assistant division production superintendent of the Stanolind Oil & Gas Co., has joined Tennessee Production as director of geology and petroleum engineering.

JOHN S. MCELWAIN has been appointed sales manager of New York State Natural Gas Corp. He has previously been assistant sales manager of the Peoples Natural Gas Co.

Coincident with the return of J. W. MOHLER, after 10 months as an official with the National Production Board in Washington, to the Caterpillar Tractor Co., San Leandro, Calif., the company has reassigned duties of its sales department executives and created another position of assistant director of sales. In this position Mr. Mohler will take full responsibility for promotional activities of the department; J. J VALENTINE and W. S. ZEIGLER will continue as assistant directors—Mr. Valentine in charge of western, plains, and industrial divisions and Mr. Zeigler handling central, eastern and governmental sales divisions.

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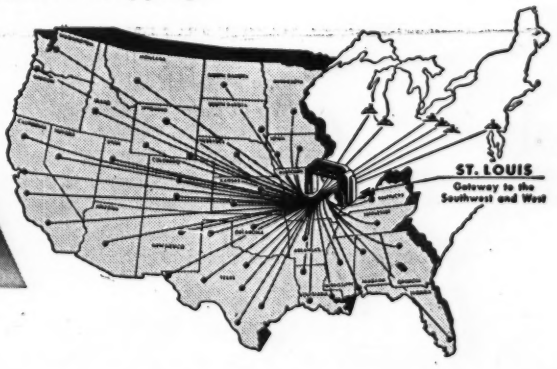
Utility men . . . contractors . . . pipeliners . . . are invited to visit our plant in St. Louis—the finest pipe coating and wrapping plant. Your pipe is stored on rail skids . . . handled on skidways and spoolways . . . steel grit cleaned . . . warmed before priming . . . warmed before coating and wrapping . . . inspected with electrical holiday detectors . . . and loaded in pyramids, with excelsior padding and reinforced paper covering to exceed AAR specifications. Temperatures are exactly controlled in all areas of our plant.

No where else can be found the modern, efficient pipe coating and wrapping methods used in this plant. Exacting procedures create maximum bond and ideal coating and wrapping.



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New Products

For additional information on these products use coupon on p. 76.

18 Pipeline Pig

This new 24-in. pipeline "pig" has 32 separate brush segments with heavy, individual coil springs under each brush segment. Brush area is nearly 1000 sq ft. The coil spring forces the brush outward against pipe wall, compensating for all brush wear. Featured are newly designed neoprene scraper cups that are interchangeable with steel scrapers and new style brushes that do not lose tension. The pipeline cleaner can be used in natural gas lines, 12-in. through 30-in., as well as products and crude lines.

Cleaner Pipelines Co.

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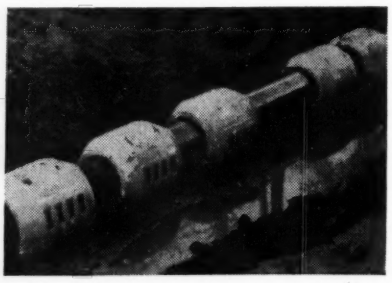


19 Concrete Weights

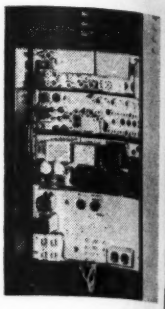
Allan Edwards Inc. has recently redesigned and streamlined its line of concrete river weights used to stabilize pipelines in rivers or marshes. The size range has been increased to cover pipe from 2½ to 36 in. and a variety of different form sizes makes it possible to select the best type for the correct buoyancy and spacing.

The concrete is dense, smooth, and well-reinforced with basket-tied preformed reinforcing. Lifting bails are cast in to enable the weight to be easily handled in loading and unloading operations. The inside surface is extremely smooth so that the pipe or coating will not be damaged in installation and the inside diameter can be varied to fit requirements.

Allan Edwards Inc.

■

20 Base Station

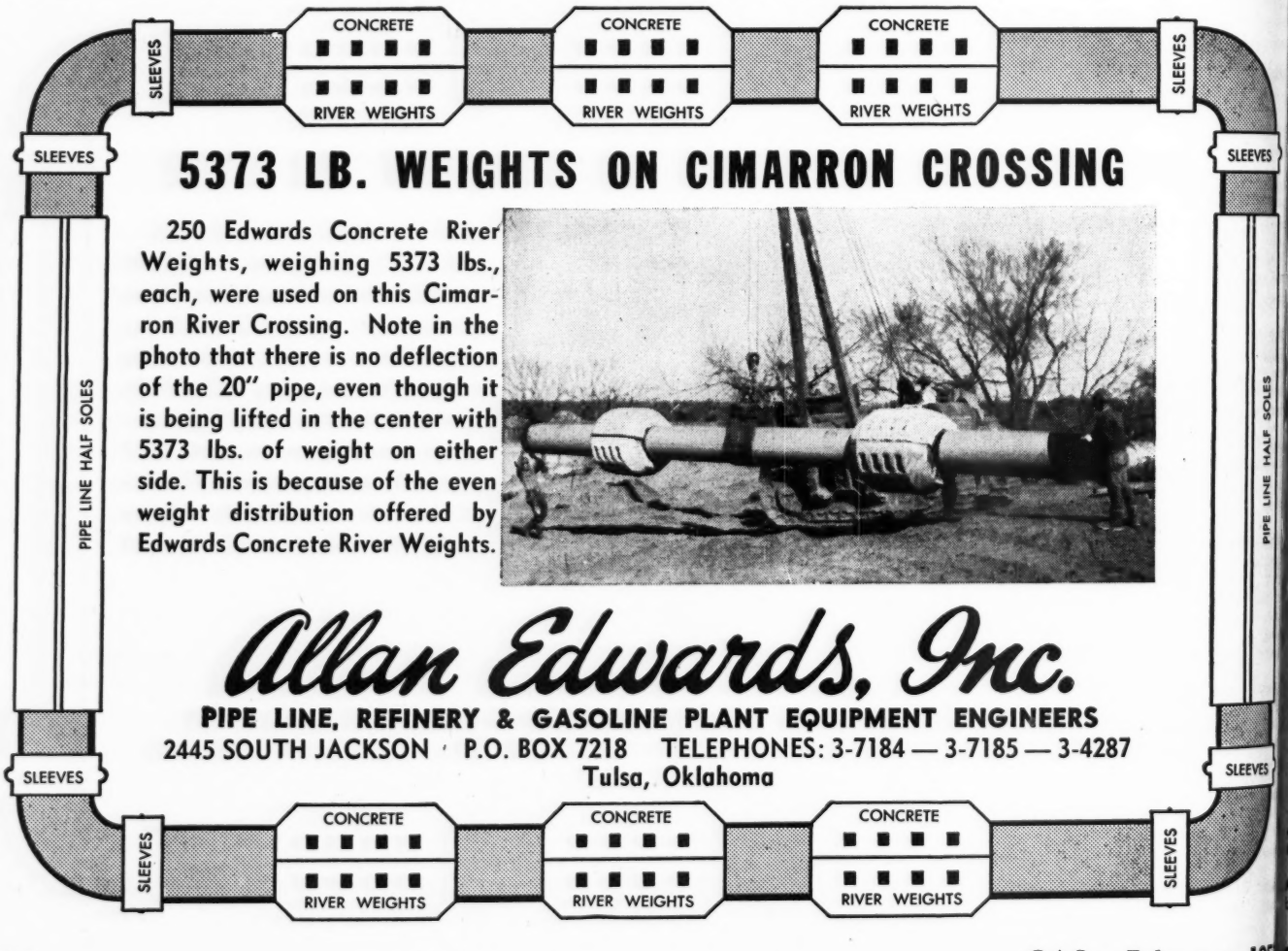


A new remotely controlled base station completes Motorola's recently announced line of 450 to 470 m.c. two-way radio equipment. It is used as an automatic relay station to increase the area of operations of a base-to-mobile communications system or to extend the length of a signal path between the end points of a point-to-point radio relay system. The equipment can also be used in installations located some distance from the point of audio termination.

The FCC has recently announced approval of the 460 to 470 m.c. band for citizens' use with this type of equipment. Previously, two-way radio operation was restricted to the 25-50 m.c. and 152-174 m.c. bands.

The new base station is housed in a weather-proof cabinet suitable for pole mounting.

Motorola Inc.


CONCRETE
RIVER WEIGHTS
SLEEVES
PIPE LINE HALF SOLES
5373 LB. WEIGHTS ON CIMARRON CROSSING
250 Edwards Concrete River Weights, weighing 5373 lbs., each, were used on this Cimarron River Crossing. Note in the photo that there is no deflection of the 20" pipe, even though it is being lifted in the center with 5373 lbs. of weight on either side. This is because of the even weight distribution offered by Edwards Concrete River Weights.
Allan Edwards, Inc.
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Progress Reports

PLANNED

ATLANTIC SEABOARD CORP. and **VIRGINIA GAS TRANSMISSION CORP.**, Charleston, W. Va. Docket G-2062 for 5000-hp compressor station in Braxton county, W. Va.; 6600-hp station in Upshur county, W. Va.; and 5000-hp station in Shenandoah county, Va.; supercharging 3 units from 880 hp to 1100 hp and installation of one 1100-hp unit at existing station in Hardy county, W. Va.

CAROLINA NATURAL GAS CORP., Charlotte, N. C. Docket G-1956 for 40 miles of line to connect with Transco line near Kings Mountain, N. C., extending to Rock Hill, S. C., with laterals to four South Carolina points.

CENTRAL WEST UTILITY CO., Kansas City Docket G-1682, four alternate plans to serve Clay county, Mo.

CHATTAHOOCHEE NATURAL GAS CO., Birmingham. Docket G-2066 for 70 miles of line in northwest Georgia, to connect with system of Southern Natural in Floyd county.

CHICAGO DISTRICT PIPELINE CO., Joliet, Ill. Docket G-2090 for 3.4 miles of 36-in., 31.2 miles of 30-in. and a .3 mile river crossing of 24-in. pipe in the Chicago area.

CONNECTICUT GAS CO., Berlin. Docket G-1954 for 3 short pipelines, totaling about 2 miles, to extend from Connecticut Light & Power gas plants to Algonquin Gas Transmission Co. from plants at Waterbury, Willimantic and Putnam, Conn.

CUMBERLAND & ALLEGHENY GAS CO., Pittsburgh. Docket G-2059 for 17 miles of line in Garrett and Allegany counties, Md. and Mineral county, W. Va. and retirement of 75 hp in compressor units at station in Preston county, W. Va.

EAST OHIO GAS CO., Cleveland. A 125-mile, 26-in. pipeline to serve Cleveland area from point just south of Toledo.

FREDERICKSBURG NATURAL GAS CO., Fredericksburg, Va. Docket G-2041 for 28½ miles of 4¼-in. line and .72 mile of 3½-in. line connecting with Transco line, extending to Fredericksburg and area.

GLACIER GAS CO., Butte, Mont. Dockets G-1816, G-1817, G-1818 for 285 miles of 20-in. from northeast of Kalispell, Mont. to Spokane, Wash.; 91 miles of 8⅝-in. from Spokane to Lewiston, Idaho; 120 miles of 16-in. from Spokane to Hanford, Wash.; 130 miles of 12¾-in. from Spokane to south of Trail, B. C.

GULF INTERSTATE GAS CO., Houston. Docket G-2058 to construct 860 miles of 30-in. line from Point Rayne, La. to Boyd county, Ky., 229 miles lateral lines and five 8000-hp compressor stations.

HOME GAS CO., Pittsburgh. Docket G-2059 for 46.7-mile pipeline in Tioga and Broome counties, N. Y. and retirement of 180 hp in compressor units at a station in Broome county.

INDIANA GAS & WATER CO. INC., Indianapolis. Dockets G-1813 and G-1937, for 19 miles of 8-in. paralleling Panhandle Eastern Pipe Line's lateral between Panhandle mainline and Crawfordsville; 13 miles of 6-in. paralleling Panhandle lateral from its mainline to Lebanon; both lines to be operated by Panhandle.

KANSAS NEBRASKA NATURAL GAS CO., Hastings. Docket G-1857. To build 179 miles of line in Kansas and Nebraska and rearrange certain compressors, stub lines and metering stations to serve new mainline industrial customers.

LONE STAR GAS CO., Dallas. Docket G-2005 for a 2640-hp compressor station and 5 miles of 12-in. line to New York City field reservoir, Clay county, Texas.

MANUFACTURERS LIGHT & HEAT CO., Pittsburgh. Docket G-2059 for 194 miles of line and retirement of 171 miles of line at points in Pennsylvania, West Virginia and Ohio; retirement of 440 hp in compressor units at station in Fayette county, Pa.

MISSOURI CENTRAL NATURAL GAS CO., Macon, Mo. Docket G-1509 for 25 miles of 6-in. from Moberly to Macon, Mo.

MISSOURI PUBLIC SERVICE CO., Warrensburg. Docket G-2057 for 109.3 miles of 8- and 10-in. main line and 27.1 miles of lateral lines. System to connect with Panhandle Eastern Pipeline Co. line at Franklin, Mo. and extend northwest.

MORGANFIELD NATURAL GAS CO., Morganfield, Ky. Docket G-1935 for a 31-mile, 4- and 6-in. line lateral to proposed Texas Gas Transmission Corp. line, to serve 6 Kentucky communities.

NATURAL GAS CO. OF W. VA., Pittsburgh. Docket G-2059 for 7.46 miles of line and retirement of same amount in Columbiana county, Ohio.

NEW YORK STATE ELECTRIC & GAS CORP., Ithaca. Docket G-1999 for total of 49 miles of pipeline; 25 miles 10-in. from DeRuyther to Norwich, N. Y., 24 miles 8-in. from Norwich to Oneonta, N. Y.

NEW YORK STATE NATURAL GAS CORP., Pittsburgh. Docket G-1980 (in part) for a 75-mile, 20-in. line from southern end of Driftwood field line to main dual line in Armstrong county, Pa. To be constructed in 1953.

NORTHERN NATURAL GAS CO., Omaha. Docket G-1918 for 400 miles of 24-in. pipe from the United States-Canadian border to a point near Minneapolis and two compressor stations with 5280 hp each.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2009 for a 6.5 mile 30-in. loop line

1989 ANNUAL CONVENTION
RETIRED CORROSION ENGINEERS
You mean that line you laid way back in '52?
Let's see—You coated that with ROSKOTE didn't you?
Yeah, well they had to move a section of it last month. This is a piece of it. Good as NEW!
ROSKOTE

And, of course, our most sincere wish for you gentlemen who are battling with pipeline corrosion is that you outlive the Roskote with which you are protecting your pipelines today.

Roskote is a coating of indefinitely long life. It is made from resins chosen primarily for their exceptionally high electrical resistivity. It is a quick drying cold-applied mastic, characterized by its extreme toughness, high tensile strength, resistance to both temperature changes and reaction to either acid or alkaline soil conditions.

Roskote requires no primer; requires no field mixing or heating. You simply open the container and begin spraying or brushing. Ask for a free sample. Try it for fast, easy application. Subject it to the most severe test your pipeline is apt to meet and see for yourself! Write:

Ask about the Roskote-Glas-Wrap reinforced protection for pipelines.

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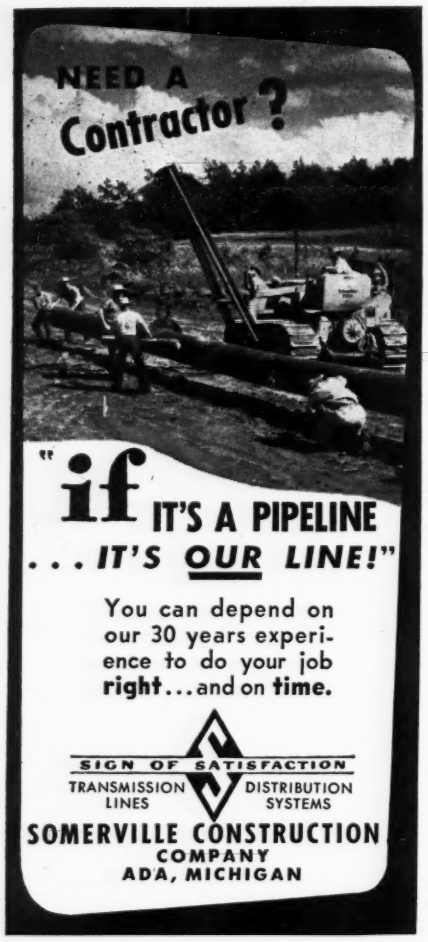
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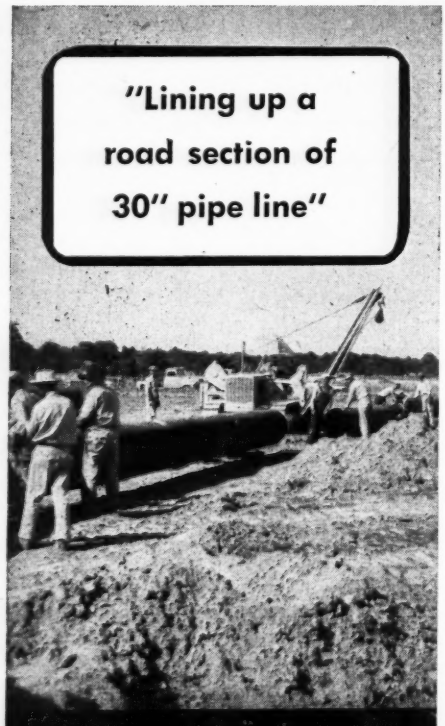
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from Bushton, Kan. compressor station, northeasterly to a point in Ellsworth county; a 1.4 mile 8⅝-in. branch line from its Omaha branch line to a proposed regulating station near La Platte in Sarpy county, Nebr.; a 1320-hp addition to Hugoton, Kan. compressor station.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2063 for 442 miles of mainline additions to connect with Permian Basin Pipe Line Co. system, and 73,600-hp in new and existing stations in Texas, Oklahoma, Kansas, Nebraska, Iowa, Minnesota and South Dakota. Also 475 miles of branch lines and additions to serve customers in Iowa, Minnesota, Nebraska and South Dakota.

NORTHWEST NATURAL GAS CO., New York. Docket G-996 for 1296 miles of 18-, 20-, 22-, and 24-in. line in Washington, Idaho, Oregon and British Columbia, together with laterals and four compressor stations aggregating 27,500 hp.

OHIO FUEL GAS CO., Columbus. Docket G-2013 for 34.5 miles of 20-in. loop in Ohio. Construction tentatively scheduled to begin March 15, 1953.

PACIFIC NORTHWEST PIPELINE CORP., Houston. Docket G-1429 for 1384 miles main line; 316 miles of spur and lateral lines; and 8 compressor stations totaling 61,000 hp, to extend from Ignacio, Colo., in the San Juan basin, to Bellingham, Wash. (Seattle area).

PERMIAN BASIN PIPELINE CO., Omaha. Docket G-1928 for facilities to carry gas from Upton county, Texas, and Lea county, N. M. to connection with 24-in. El Paso Natural line to Dumas, Texas; from connection with El Paso line at Dumas to connection with Northern Natural line in Carson county, Texas.

SHENANDOAH GAS CO., Lynchburg, Va. Docket G-1448 for 39 miles of line from a point near Middletown, Va. to points near Winchester, Va. and Martinsburg, W. Va.

SOUTH CAROLINA NATURAL GAS CO., Columbia, S. C. Docket G-1961 for a 160-mile pipeline in Aiken, Lexington, Richland, Orangeburg, Dorchester, Charleston, and Berkeley counties, S. C.

SOUTH GEORGIA NATURAL GAS CO., Birmingham. Docket G-1915 for a 339-mile line to serve communities in southwest Georgia and northern Florida. Main trunk would connect with system of Southern Natural Gas Co. in Lee county, Ala., and extend to Albany, Ga., with a branch to Tallahassee, Fla.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907 (partially approved). Application still open for 715 miles of various sizes pipelines and three compressor stations totaling 14,200 hp in Alabama, Georgia, Mississippi.

TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-1921 and G-1922 for a presidential permit to construct and operate facilities at the International Boundary north of Niagara Falls and for FPC certificate for 45 miles of 20-in. from Buffalo to Niagara; 107 miles of 26- and 30-in. loop on mainline; six new compressor stations with 80,500 hp; 51,500 hp in old stations; 50 miles of laterals; aerial suspension bridge over Niagara river.

TRANS-CANADA PIPE LINES LTD., for 2200-mile line from Alberta to major cities as far east as Montreal.

UNITED FUEL GAS CO., Charleston. Docket G-2061 for 50.5 miles of pipeline from new 2640-hp compressor station at existing storage pool in Wood county to Lanham station in Putnam county, W. Va. Also acquisition of leaseholds and authority to drill wells, install well and field lines for proposed new storage pool.

UTAH NATURAL GAS CO., Salt Lake City. To build a 96-mile, 20-in. line from Clear Creek wells in Carbon county to Salt Lake City.

WESTCOAST TRANSMISSION CO. INC., Wilmington, Del., 349 miles, including 277 miles from Sumas, Wash. to Portland, Ore. with short branches to a number of cities in the two states

A 20-minute color film recently released by H. C. Price Co. deals with the problems of marine pipeline crossings. Entitled "Herman Hevicote," the film uses both live photography and animation to show the application of Price's concrete jacket for pipelines. Showings of the film can be arranged through the company.

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and 72 miles of laterals and 13 measuring stations. To connect with 683 mile 24-in. line to be built by parent company, Westcoast Transmission Co. Ltd., from Peace river area of Alberta and B.C. Location survey under way.

UNDER WAY

ALGONQUIN GAS TRANSMISSION CO., Boston. Facilities including several laterals remain to be completed. Work held up pending further FPC hearings.

ARKANSAS-MISSOURI POWER CO., Blytheville. Docket G-1900 for a line from Campbell, Mo. to Blytheville, Ark., and a line from a point just west of the St. Francis river in Clay county, Ark. to Rector, Ark. The total of 140 miles of pipeline is to serve 13 communities in Arkansas and 5 in Missouri.

ATLANTIC SEABOARD CORP., Charleston. Docket G-1850 for two new compressor stations aggregating 7640 hp, with 3080 hp addition to be installed in existing station, all in West Virginia. J. F. Pritchard Co. at work on all three projects.

COLORADO-WYOMING GAS CO., Denver. Docket G-1821 for 1½-mile 8-in. loop near Cheyenne; 2-mile, 8-in. replacement on Golden, Colo. lateral.

EL PASO NATURAL GAS CO. Dockets G-1630, G-1631 for about 170 miles of 30-in. mainline loop on existing transmission system, and about 153,000 hp in mainline and booster compressor stations.

MIDSOUTH GAS CO., Little Rock, Ark. Dockets G-1445 and G-1680 for 191 miles of line in Greene, Crittenden, St. Francis, Lee, Phillips, Monroe, Woodruff, Poinsett, and Cross counties, Ark. Nine distribution systems under way; 73 miles completed; 38-mile line acquired. Additional lines and systems to be constructed in 1954.

MILWAUKEE GAS LIGHT CO., Milwaukee. Two lines, one 10 miles of 14- and 16-in. pipe extending south from Cedarburg to the Milwaukee county line in service Jan. 1. Construction scheduled to begin this month on a 20-in. line extending east 7 miles from Menomonee Falls. To be completed in early summer.

NORTH[illegible] NATURAL GAS CO., Omaha, has Reese B[illegible]rs Construction Co. at work on 140 miles of g[illegible]thering lines in Kansas and Oklahoma. A[illegible]t one-third complete. Remainder to be com[illegible]ted by spring 1953.

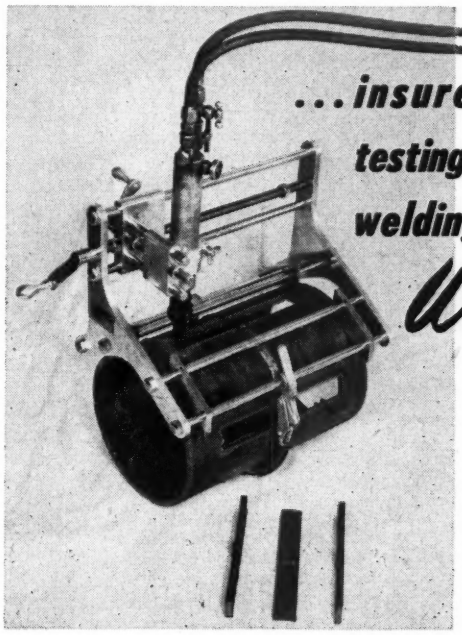
NORTHER[illegible] NATURAL GAS CO., Omaha. Docket G-1618 for 213 miles of 26-in. loop lines in Texas, Oklahoma, Iowa, Kansas, Nebraska and Minnesota, and 100,160-hp additional compressor capacity. R. H. Fulton at work on 1610 ft river crossing in Kansas and 23 miles of loop north of Clifton, Kan. compressor station. G. G. Griffis Construction Co. at work on 12 miles of line from Portland avenue distribution station, Minneapolis, to St. Paul.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1651 for 86.25 miles 34-in. loop and 19,540 hp addition on existing Topock-Milpitas line. Engineers Limited Pipeline Co. at work on loop construction. Bechtel Corp. at work at Hinkley and Kettleman compressor station. Expect completion of project in summer 1953.

SOUTHERN CALIFORNIA GAS CO. and **SOUTHERN COUNTIES GAS CO.,** Los Angeles. Docket G-1718 for about 20 miles of 30-in. loop line east from Whitewater, Calif., and 13,520-hp additions to compressor facilities on existing line from California-Arizona boundary to Los Angeles. Construction on compressors under way. Expected to be completed by March.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1993 for a 3300-hp compressor station to be located on company's 14-in. supply line from Logansport (La.) gas field.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907 (in part). Miscellaneous sized lines for gathering system, 384 miles to be laid



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south of Gwinville, Miss.; 5400-hp compressor at Gwinville; and 3300-hp compressor station at Estopinal, La. Work started.

TEXAS GAS TRANSMISSION CORP., Owens- Docket G-1854 for 15.1 miles 12-in. line and loop line in six sections. H. C. Price has 44 miles remaining to be completed next spring.

UNITED NATURAL GAS CO., Oil City, Pa. Docket G-1854 for 15.1 miles 12-in line and replacement of 6.5 miles 8-in. line in Venango county, Pa. delayed by pipe deliveries. Expected to be completed by June 1, 1953.

PENDING CONSTRUCTION

ARKANSAS-LOUISIANA GAS CO., Shreveport. Docket G-1979 for 6 miles of 12¾-in. line in Hot Spring county and a 7500-hp compressor station on the company's "Line S" between Waskom, Texas and Perla, Ark. Delta Engineering Corp. at work.

CITIES SERVICE GAS CO., Oklahoma City. Docket G-2038 for installation of 11,400 hp compressor capacity—three 1600 hp units to be added to its Greensburg station, Kiowa county; six 1100 hp units in a new station in Harvey county, Kan. Construction scheduled to start about March 1, 1953.

EAST TENNESSEE NATURAL GAS CO., Knoxville. Docket G-1336 for a 100-mile, 16-in. line from near Knoxville to Kingsport, Tenn. with about 58 miles of various sized lateral lines.

NEVADA NATURAL GAS PIPE LINE CO., Las Vegas. Docket G-1888 for 114 miles of 12¾-in. line from Topock, Ariz. to Las Vegas and Henderson areas. Construction scheduled to start about Feb. 1, 1953. H. G. Laub, pres., 7th & B St., Victorville, Calif.

OKLAHOMA NATURAL GAS CO., Tulsa. To build 50-mile 18-in. line from Sapulpa to Pryor, Okla. to serve chemical plant to be constructed by Deere & Co. and Grand River Dam Authority furnaces. Construction to begin in the spring; to be completed by fall 1953.

TENNESSEE GAS TRANSMISSION CO., Houston. Dockets G-1573 and G-1614 for 591 miles of line parallel to existing system, a 304-mile line from near Mercer, Pa. to Utica, N. Y. with a total of 165,000 hp to be installed at new and existing compressor stations. Also 250 miles of miscellaneous lines.

CONTRACTS LET

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-1892 for 20 miles of 16-in. line from Burrell to a point near Easton, contract let to Alex Robertson Co. with completion scheduled for mid-March; 15 miles of 20-in. pipe extending from Helm and joining the system's Topock-Milpitas line in Fresno county; and for 15.5 miles of 12¾-in. in Madera county parallel to the existing Madera-Livingston line, scheduled for construction in 1953-54.

APPROVED

IOWA-ILLINOIS GAS & ELECTRIC CO., Davenport. Docket G-2012 for 22 miles of line to connect with Natural Gas Pipeline Co. of America system in Mahaska county and extend to a point in Ottumwa county, Iowa.

TEXAS EASTERN TRANSMISSION CORP., Shreveport. Docket G-1947 for 315 miles of 24-in. line from a connection with Wilcox Trend line at Provident City, Texas, to connection with existing system near Castor, La. Contract let to H. B. Zachary Co., San Antonio, Texas.

WILCOX TREND GATHERING SYSTEM INC., Dallas. Docket G-1959 for one 2200-hp compressor station; 157 miles of line from McMullen county to connection with Texas Eastern near Provident City, Texas; and about 60 miles of laterals.